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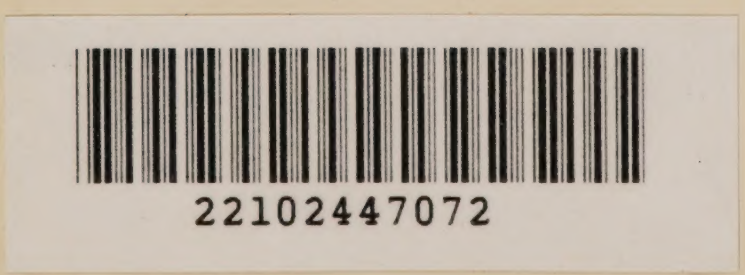
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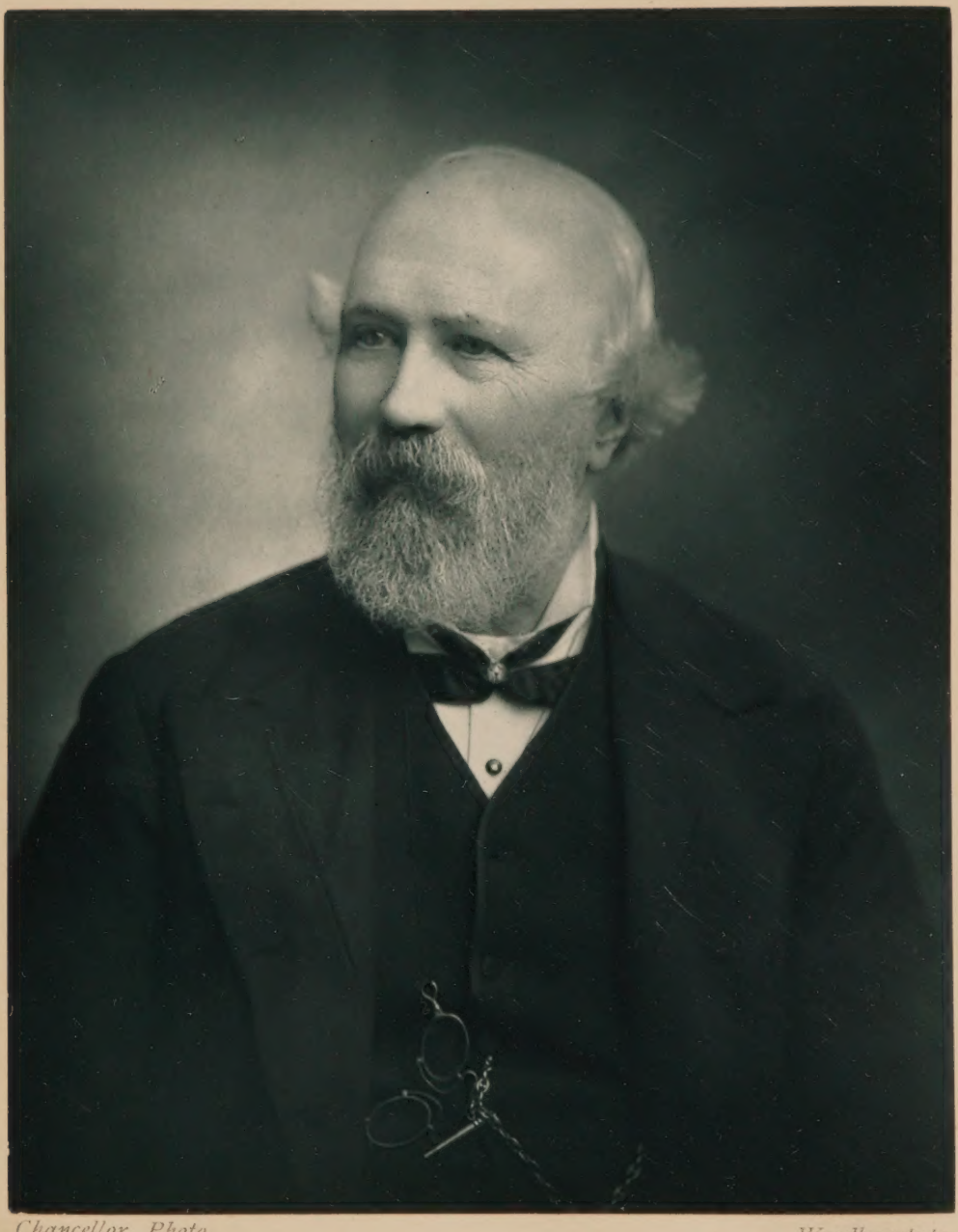

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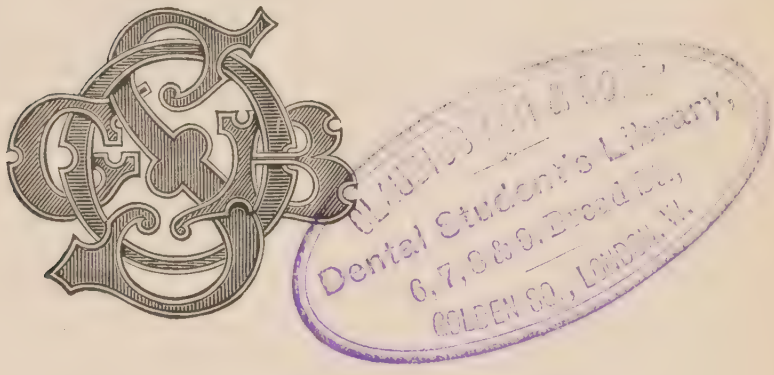
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1891 Baker, Arthur W. W., M.D.Dub., F.R.C.S.Irel., L.D.S. Irel. 18, Lower Fitzwilliam Street, Dublin. (C. 1894-95.)

1879 Balcomb, Thos., L.D.S.Irel. 44, David Place, Jersey.

1892 Balding, Edmund, Junr., L.D.S.Eng. Fairbridge House, 732, Holloway Road. N.

1887 Baldwin, Harry, M.R.C.S.Eng., L.D.S.Eng. 37, Cavendish Square. W. (C. 1894-95.)

1861 Balkwill, F. H., L.D.S.Eng. 3, Princess Square, Plymouth. (C. 1886.87.88. V.P. 1892.93.94-95.)

1893 Baly, Charles Francis Peyton, L.D.S.Eng. 140, Harley Street. W.

1889 Barnard, Alfred Geo. Wm., L.D.S.Eng. Rostherne, Upper Richmond Road, Putney. S.W.

1870 Barrett, Ashley William, M.B.Lond., M.R.C.S.Eng., L.D.S.Eng. 42, Finsbury Square, E.C. (C. 1887. 88.89. H.F.S. 1880. H.S. 1879. V.P. 1894-95.)

1893 Barrett, Frederick Walter, L.D.S.Eng. 42, Finsbury Square. E.C.

1884 Bartlett, Edward, M.R.C.S.Eng., L.D.S.Eng. 38, Connaught Square. W.

1890 Bateman, G. W., L.D.S.Eng. 93, Ladbroke Grove, Notting Hill. W.

1882 Bates, W., L.D.S.Irel. 30, Park Green, Macclesfield.

1877 Bell, Martin Luther, L.D.S.Eng. St. Margaret Street, Canterbury.

1863 Bellaby, G. W., L.D.S.Irel. Park Row, Derby Road, Nottingham.

1880 Bennett, Fred Jos., M.R.C.S.Eng., L.D.S.Eng. 24, George Street, Hanover Square. W. (C. 1891.92.93.)

Elected

1878 Bennett, Storer, F.R.C.S.Eng., L.R.C.P.Lond., L.D.S. Eng. 17, George Street, Hanover Square. W. (C. 1884. H.F.S. 1885. Curator 1886.87.88.89.90.91.92.93. 94-95.)

1879 Betts, Ed. G., M.R.C.S.Eng., L.D.S.Eng., L.S.A. 37, Cavendish Square. W. (C. 1886.87.91.92.93. H.F.S. 1888. H.S. 1889.90.)

1882 Bevers, Edm. Aug., M.R.C.S.Eng., L.S.A. 46, Broad Street, Oxford.

1893 Blain, Ed. John, L.D.S.Eng. Bridge House, Taunton.

1890 Bloom, Marcus J., Jun., L.D.S.Irel. 18, Westland Row, Dublin.

1878 Bloom, Mark J., L.D.S.Irel. 18, Westland Row, Dublin.

1871 Bogue, Edward A., M.D., D.D.S. 63, West Forty-eighth Street, New York City.

1883 Bonnell, Bentley J., 94, Cornwall Gardens, South Kensington. S.W. (C. 1892.93.)

1893 Briault, E. H. Lewis, L.D.S.Eng. 145, Finchley Road. N.W.

1885 Bridgman, J. B., L.D.S.Irel. St. Giles's Street, Norwich.

1886 Briggs, F. H., L.D.S.Edin. 5, Park Crescent, Torquay.

1864 Browne-Mason, J. T., L.D.S.Eng. 6, Southernhay, Exeter. (C. 1880.81.82. V.P. 1883.84.85.)

1877 Brownlie, J. R., L.D.S.Eng. 10, Brandon Place, Glasgow. (C. 1885.86.87.)

1878 Brunton, George. Hillary Mount, Woodhouse Lane, Leeds. (C. 1886.87.88.)

1890 Butcher, J. O., L.D.S.Eng. 26, Harley Street. W.

1862 Campbell, Walter, L.D.S.Eng. 27, South Tay Street, Dundee. (C. 1878.79. V.P. 1882.)

1886 Campion, Geo. G., L.D.S.Eng. 264, Oxford Road, Manchester. (C. 1893.94-95.)

1862 Campion, H., M.R.C.S.Eng. 264, Oxford Road, Manchester. (C. 1868.69. V.P. 1876.77.78.79.)

Elected

1875 Canton, Frederick, L.R.C.P.Lond., M.R.C.S.Eng., L.S.A., L.D.S.Eng. 24, Upper Wimpole Street, Cavendish Square, W. (C. 1883.84.85. H.S. 1880.81. 82. Ed. Trans. 1886.87.88. V.P. 1890. P. 1894-95.)

1887 Canton, Fred Arthur, L.D.S.Eng. 34, Baker Street, Portman Square. W.

1876 Carteighe, John, Jun., L.D.S.Eng. 5, Norland Terrace, Holland Park. W.

1880 Carter, T. S., L.D.S.Eng. 26, Park Square, Leeds. (C. 1891.92.93.)

1876 Cartwright, Alexander, M.R.C.S.Eng., L.D.S.Eng. 32, Old Burlington Street. W. (C. 1883.84.85.)

1893 Clarence, Thos. Herbert, L.D.S.Eng. Chase Side, Enfield. N.

1891 Clark, Charles A., L.D.S.Irel. Vega House, 7, London Road, Forest Hill. S.E.

1862 Clerk, Smollett W., Rutland House, Madras, India.

1870 Cobb, John S., L.D.S.Eng. 28, King Street, Great Yarmouth.

1882 Coffin, Walter. 94, Cornwall Gardens. S.W. (C. 1888. Ed. Trans. 1889.90.91.92.)

1864 Cole, J. F., L.D.S.Eng. 11, Museum Street, Ipswich. (C. 1884.85.)

1892 Colyer, Arthur Reginald, L.R.C.P.Lond., M.R.C.S. Eng., L.D.S.Eng. Burton House, 253, Brixton Road. S.W.

1890 Colyer, J. Frank, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. 11, Queen Anne Street, Cavendish Square. W. (H.F.S. 1893. H.S. 1894-95.)

1881 Cook, Stanley, L.D.S.Eng. 58, New Broad Street. E.C.

1892 Cooksey, Edw. Thos., L.D.S.Eng. 26, Marine Parade, Worthing.

1861 Corbett, Daniel, M.R.C.S.Eng., L.D.S.Eng. 12, Clare Street, Dublin. (C. 1872.73.74. V.P. 1878. P. 1888.)

1888 Corbett, Daniel, Jun., B.A.Dub., F.R.C.S.Irel. 12, Clare Street, Dublin.

1876 Corbett, J. F., L.D.S.Eng. 5, Cavendish Place. W. (C. 1886.87.88.)

Elected

1880 Cotterell, Chas. Vincent, L.D.S.Irel. 76, Grosvenor Street. W.

1864 Cox, Edwin, L.D.S.Eng. 148, Queen Street, Auckland, New Zealand.

1891 Coxon, Stephen Arthur, L.D.S.Irel. 4, York Row, Wisbech.

1886 Crank, Peter, 64, North Terrace, Adelaide, South Australia.

1882 Cunningham, George, M.A. Cantab., L.D.S.Eng., D.M.D. Harvard (U.S.). 2, King's Parade, Cambridge.

1889 Curnock, Geo. Dennis, L.D.S.Eng. 30, Finsbury Circus. E.C.

1881 Davis, Charles D., M.R.C.S.Eng., L.D.S.Eng. Cumberland Lodge, 1, Streatham Hill. S.W. (C. 1893.94-95.)

1892 Davis, Harry, L.D.S.Eng. 14, Church Road, Richmond, Surrey.

1887 Davis, Henry, M.R.C.S.Eng., L.S.A. 60, Queen Anne Street, Cavendish Square. W.

1882 Davis, Marcus John, L.D.S.Eng. 42, Harley Street. W.

1886 Davis, Murray, L.D.S.Eng. 18, Wimpole Street, Cavendish Square. W.

1865 De Lessert, A. A., L.D.S.Irel. 220, Union Street, Aberdeen. (C. 1890.91.)

1869 Dennant, J., L.D.S.Eng. 1, Sillwood Road, Brighton. (C. 1876.77.78.)

1880 Dewes, Hugh William, L.D.S.Eng. 32, Harley Street. W.

1868 Dickinson, M. de C., L.D.S.Eng. 3, Verulam Place, St. Leonard's. (C. 1889.90.91.)

1882 Dowsett, George Harris. 1, Gloucester Street, Portman Square. W.

1893 Durward, James Stewart, L.D.S.Edin. 137, Mayfield Road, Edinburgh.

1892 Edgelow, Percy, L.R.C.P.Edin., M.R.C.S.Eng. 7, Old Burlington Street. W.

Elected

1892 Ellwood, Francis Henry, L.D.S.Irel. Granville House, Redhill, Surrey.

1886 England, W. J., L.D.S.Eng. 40, Wimpole Street, Cavendish Square. W.

1856 English, T. R. M., Colmore Row, Birmingham. (C. 1860. 61.65.66.67. V.P. 1874.75.)

1879 Ewbank, Francis, M.R.C.S.Eng., L.S.A., L.D.S.Eng. 11, Queen Anne Street, Cavendish Square. W.

1872 Fairbank, John, M.R.C.S.Eng. 18, George Street, Hanover Square. W. (C. 1887.88.89.)

1886 Farebrother, H. Lloyd, L.D.S.Eng. New Street, Salisbury.

1880 Farnsworth, Charles, L.D.S.Irel. 96, Oxford Street. Manchester.

1887 Fergus, Oswald, L.D.S.Glas. 27, Blythswood Square, Glasgow.

1881 Fernald, H. P., L.D.S.Irel., D.D.S.Boston, Mass. Alma House, Rodney Place, Cheltenham.

1876 Field, W. George. 23, Park Street, Park Lane. W.

1863 Finzi, S. L., L.D.S.Eng. 94, Oxford Gardens, N. Kensington. W.

1890 Fisk, Wm. John, L.D.S.Edin. 181, High Road, Kilburn. N.W.

1878 Foran, J. C., L.D.S.Irel. Elmslea, 7, Seaside Road, Eastbourne.

1892 Forsyth, Harry Arthur, L.D.S.Eng. 24, George Street, Hanover Square. W.

1860 Forsyth, W. F., L.D.S.Eng. 24, George Street, Hanover Square. W. (C. 1871.72.73. V.P. 1888.89.) (Trustee.)

1879 Fothergill, Edward, L.D.S.Eng. 7, Saville Place, Newcastle-on-Tyne.

1885 Fothergill, J. A., M.R.C.S.Eng., L.D.S.Eng., D.D.S. Penn. 77, Northgate, Darlington.

1893 Fraser, Jas. Leslie, L.D.S.Edin. 5, Castle Street, Inverness.

Elected

1887 Fripp, Trude, L.D.S.Edin. and Irel. Station Road, Willesden Junction. N.W.

1893 Gabell, Douglas Phillimore, L.DS..Eng. 47, East Street, Brighton.

1893 Gardner, Ernest, L.D.S.Eng. 139, Victoria Street. S.W.

1875 Gartley, John A., L.D.S.Eng. 5, Sackville Street. W. (C. 1894-95.)

1874 Gibbings, Ashley, M.R.C.S.Eng., L.D.S.Eng. 18, Stratford Place. W. (C. 1882.83.84. L. 1889.90.91.92.93. V.P. 1894-95.)

1891 Gill, H. Beadnell, L.D.S.Eng. Chester Villa, Upper Norwood. S.E.

1887 Glaisby, Walter, L.D.S.Irel. 4, St. Leonards, York.

1892 Goddard, Henry Ernest, L.D.S.Glas. Oxford Street, Nottingham.

1893 Goodman, Wm. Henry, L.D.S.Eng. 16, Palace Gate, Exeter.

1888 Gould, Horace J., L.D.S.Eng. 18, Mount Road, Madras, India.

1863 Grant, W. 39, Church Street, Inverness.

1886 Grayston, William Cass, L.D.S.Irel. 1, Pavilion Terrace, Scarborough.

1890 Greenfield, John, L.D.S.Eng. 11, Brook Street, Hanover Square. W.

1857 Gregson, G., M.R.C.S.Eng., L.D.S.Eng. 63, Harley Street. W. (C. 1867.68.69.84. H.F.S. 1873. H.S. 1870.71.72. V.P. 1884.85.86.)

1874 Halliday, Middleton W., L.D.S.Eng. 4, Nottingham Street. W.

1892 Handley, C. W. Croft, L.D.S.Glas. The Elms, 15, High Street, Stoke Newington. N.

1877 Harding, Milward. 23, Park Square East, Regent's Park. N.W.

Elected

1867 Harding, T. Henry G., L.D.S.Eng. 23, Park Square East, Regent's Park. N.W. (H.S. 1872.73.74. V.P. 1891.92.93.)

1874 Harding, William E., L.D.S.Eng. 28, Castle Street, Shrewsbury. (C. 1884.85.86. V.P. 1893.94-95.)

1883 Harris, A. Carpenter, M.R.C.S.Eng., L.D.S.Eng. 112, Harley Street. W.

1892 Harris, James Edwin, D.D.S.Mich., U.S.A. 32, Queen Anne Street. W.

1891 Harris, Theodore Wm., L.D.S.Eng. 10, Cavendish Place. W.

1883 Harrison, Richard, L.D.S.Eng. 245, Camden Road. N.W.

1886 Harrison, Walter, L.D.S.Eng., D.M.D.Harvard. 6, Brunswick Place, Hove, Brighton.

1887 Hayman, C. A., L.R.C.P., L.R.C.S.Irel., L.D.S.Eng., L.D.S.Irel. 17, Victoria Square, Clifton, Bristol.

1893 Hayward, Henry Saville, L.D.S.Eng. 12, St. Anne's Terrace, Circus Road, St. John's Wood. N.W.

1873 Hele, Warwick, L.D.S.Eng. 11, Portland Square, Carlisle. (C. 1883.84.)

1863 Henry, George, L.D.S.Eng. 38, Wellington Square, Hastings. (C. 1873.74.75. V.P. 1894-95.)

1880 Henry, Martin, L.D.S.Eng. 63, Sandgate Road, Folkestone.

1876 Hepburn, David, L.D.S.Eng. 9, Portland Place, Cavendish Square. W. (C. 1887.88.89. H.S. 1884.85,86. V.P. 1890.91.92.)

1892 Hern, George, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. 18, Stratford Place. W.

1883 Hern, William, M.R.C.S.Eng., L.D.S.Eng. 18, Stratford Place. W. (C. 1890.91.92.)

1879 Hogue, Wilson, D.M.D.Harvard. Vermont, Dean Park, Bournemouth. (C. 1892.93.94-95.)

1892 Holford, Walter Stanley, L.R.C.P.Lond., M.R.C.S. Eng., L.D.S.Eng. 23, Wimpole Street. W.

1884 Hooper, G., L.D.S.Eng. 21, New Cavendish Street. W.

Elected

1893 Hope, Arthur Curling, L.D.S.Eng. Portland House, Guildford.

1893 Hope, Hubert L., L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. Portland House, Guildford.

1892 Hopson, Montagu Frank, L.D.S.Eng. Grove House, Rosslyn Hill, Hampstead. N.W.

1891 Howkins, Thomas Maudsley, L.D.S.Irel. 57, Victoria Street, Great Grimsby.

1886 Hughes, Morgan, M.R.C.S.Eng., L.D.S.Eng. Eastbridge, Addiscombe Road, Croydon.

1880 Hugo, George Joseph, 15, Allez Street, New Town, Guernsey.

1858 Hugo, Samuel George Joseph. 15, Allez Street, New Town, Guernsey.

1883 Humby, W. R., L.D.S.Eng. 88, Newgate Street. E.C. (C. 1893.94-95.)

1871 Hunt, William A., L.R.C.P.Lond., M.R.C.S.Eng. Pen Villa, Yeovil. (C. 1879.80.81.)

1874 Hutchinson, S. J., M.R.C.S.Eng., L.D.S.Eng. 64, Brook Street. W. (H.S. 1879.80. Curator, 1881.82.83.84.85. V.P. 1886.87.88. P. 1891. T. 1893.94-95.)

1889 Huxley, F. Earle, M.R.C.S.Eng., L.D.S.Edin. 23, Waterloo Street, Birmingham. (C. 1894-5.)

1887 James, W. E., L.D.S.Irel. 14, Claremont Road, Surbiton.

1881 Jewers, Ernest E., L.D.S.Eng. 3, Athenæum Terrace, Plymouth.

1863 Karran, J. 8, Finch Road, Douglas, Isle of Man.

1875 Keeling, G. R., L.D.S.Eng. Ormonde House, Epsom.

1889 Kendall, W. H., L.D.S.Eng. 25, Finsbury Square. E.C.

1887 Kendrick, Alfred, L.D.S.Eng. Bridge House, Taunton.

1867 King, R. F. H., L.D.S.Eng. Appleton Gate, Newark.

1882 King, Thos. Edward, L.D.S.Eng. 10, Museum Street, York.

1885 Kirby, Alex., L.D.S.Eng. 8, Harpur Place, Bedford.

Elected

1887 Kissack, Frank H., L.D.S.Eng. 17, Bentinck Street, Manchester Square. W.

1886 Kluht, Henry J., L.D.S.Glas. 156, Westbourne Grove. W.

1891 Knowles, Vernon, L.D.S.Eng. Kendrick View, London Road, Reading.

1885 Lechmere, E., L.D.S.Eng. 27, Belgrave Road. S.W.

1877 Levason, Arthur G., L.D.S.Irel. 12, Bridge Street, Hereford.

1886 Levason, Peyton Grenville, L.D.S.Eng. 12, Bridge Street, Hereford.

1882 Lloyd-Williams, E., L.R.C.P.Lond., M.R.C.S.Eng., L.S.A., L.D.S.Eng. 2, James Street, Buckingham Gate. S.W. (C. 1892. Ed. Trans. 1893.94-95.)

1867 Longhurst, Henry Bell, L.D.S.Eng. 28, Old Burlington Street. W. (C. 1877.78.79.)

1883 Lucas, George J., L.D.S.Edin. Lindon Lodge, Northfleet, Gravesend.

1869 McAdam, George C., L.D.S.Eng. King Street, Hereford. (C. 1884.85. V.P. 1887.88.89.)

1884 McCall, John H., L.D.S.Eng. The Spa, 13, Belvoir Street, Leicester. (C. 1893.94-95.)

1876 Macgregor, Malcolm, L.D.S.Edin. 20, Queen Street, Edinburgh.

1876 MacLeod, William B., F.R.S.Edin., L.D.S.Edin. 16, George Square, Edinburgh. (C. 1888. V.P. 1889.90. 91. P. 1893.)

1880 Maggs, W. A., L.R.C.P.Lond., M.R.C.S.Eng., L.S.A., L.D.S.Eng. 16, Hanover Square. W. (H.F.S. 1890. H.S. 1891.92.93. L. 1894-95.)

1876 Mallet, Gilbert, 28, Bartholomew Street, Newbury.

1892 Mansbridge, Josiah, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S.Eng. 112, Harley Street. W.

Elected

1882 Mansell, Thos., L.D.S.Edin. 29, Hamilton Square, Birkenhead.

1881 Margetson, W. E., M.R.C.S.Eng., L.D.S.Eng. Roscoe House, Leeds Road, Dewsbury.

1886 Markham, R. L., L.D.S.Irel. 9, Eldon Square, Newcastle-on-Tyne.

1893 Martin, Gavin W., L.D.S.Eng. Ormond House, Harrogate.

1862 Martin, J. H. C., M.D.Edin., M.R.C.S.Eng., L.D.S.Eng. Cambridge House, Portsmouth. (C. 1871.72.73.)

1875 Martini, Luigi, M.D. Trasloco in Via Barbaroux 2, Turin, Italy.

1882 Mason, Charles Browne, L.D.S.Eng. 5, The Crescent, Scarborough.

1877 Mason, Henry B., L.D.S.Eng. 3, Bedford Circus, Exeter. (C. 1890.91.92.)

1880 Matheson, Leonard, L.D.S.Eng. 70a, Grosvenor Street. W. (C. 1889.90.)

1876 Matthew, Charles, L.D.S.Edin. 15, Ainslie Place, Edinburgh.

1883 Matthews, A. Alexander, L.D.S.Eng. 12, North Parade, Bradford.

1888 Matthews, Wm., L.D.S.Eng. Rocky Mount, Broad Green, Liverpool.

1879 May, Percy, M.R.C.S.Eng., L.D.S.Edin. 15, Endsleigh Gardens. N.W.

1877 Merson, Frank, 36, East Street, South Molton.

1878 Merson, James, L.D.S.Eng. 28, Harley Street. W.

1874 Merson, William, L.D.S.Eng. Lainston Lodge, Bournemouth.

1892 Messenger, Henry Williams, L.D.S.Irel. Clairville, 47, Rosslyn Hill, Hampstead. N.W.

1868 Mitchell, F. W., L.D.S.Eng. 176, Clapham Road. S.W.

1888 Mitchell, Wm., D.D.S.Mich. 39, Upper Brook Street, Grosvenor Square. W.

1892 Moon, William Draper, L.D.S.Eng. 8, Jesmond Road, Newcastle-on-Tyne.

Elected

1857 Morley, Henry, L.D.S.Eng. Trinity Terrace, London Road, Derby. (C. 1869.70.)

1874 Mummery, John Howard, M.R.C.S.Eng., L.D.S.Eng. 10, Cavendish Place. W. (C. 1885.86. H.F.S. 1881.82. H.S. 1883.84. V.P. 1887.88.89. P. 1892.)

1884 Mundell, Stephen, L.D.S.Eng. 38, West Southernhay, Exeter.

1889 Neale, W. H. Breward, L.D.S.Irel. 7, Newhall Street, Birmingham.

1882 Newland-Pedley, F., F.R.C.S.Eng., L.D.S.Eng. 32, Devonshire Place, Portland Place. W. (C. 1890.91.92.)

1883 Newton, Fredk. Harriss, L.D.S.Eng. 30, George Street, Hanover Square. W.

1879 Noble, Chas. J., L.D.S.Eng. 96, Cornwall Gardens. S.W.

1893 Northcroft, George, L.D.S.Eng. 4a, Portman Mansions. W.

1874 Northrop, A. L., D.D.S. 57, West Forty-ninth Street, New York City.

1859 O'Meara, Alfred. Kennedy Lodge, Simla, India. (V.P. 1879.80.81.)

1859 Orphoot, Peter, M.D.Edin. 113, George Street, Edinburgh. (V.P. 1868.69.70.72.73.74.)

1884 Pallant, Arthur, L.D.S.Irel. Orchard House, Maidenhead.

1859 Palmer, James Edwin. Priestgate, Peterboro'. (C. 1881.82.)

1885 Parkinson, Herbert S., L.D.S.Eng. 40, Brook Street. W.

1860 Parks, William J., L.D.S.Eng. 27, Newington Crescent, Kennington Park Road. S.E.

1883 Paterson, Hugh, Dental Surgeon, Sydney, N.S.W.

Elected

1887 Paterson, W. Bromfield, F.R.C.S.Eng., L.D.S.Eng. 64, Brook Street. W. (C. 1894-5.)

1877 Payne, Arthur G. Netley, Old Christchurch Road, Bournemouth.

1880 Pedley, George, 17 and 18, Railway Approach, London Bridge. S.E.

1889 Pedley, R. Denison, F.R.C.S.Edin., M.R.C.S.Eng., L.D.S.Eng. 17, Railway Approach, London Bridge. S.E.

1885 Penfold, W., L.D.S.Irel. 30, York Street, Portman Square. W.

1880 Pike, J. L. F., L.D.S.Eng. 273, Glossop Road, Sheffield.

1871 Platt, Leon J., L.D.S.Edin. 64, Murray Place, Stirling.

1882 Poinsot, P. H. V. 34, Rue de la Victoire, Paris.

1863 Porter, W. P. 44, Finsbury Pavement. E.C.

1882 Power, Thos. Henry, L.D.S.Irel. Southwold, Walton-on-Thames.

1859 Pratt, R. J. H. 2, Suffolk Place, Pall Mall. S.W.

1893 Preedy, Ed. John, L.D.S.Eng. 1, Hanover Square. W.

1883 Price, Rees, L.D.S.Eng. 163, Bath Street, Glasgow.

1883 Quinby, Henry Clay, L.D.S.Irel. 21, Rodney Street, Liverpool. (C. 1892.93.94-95.)

1883 Quinby, Melville G. C. 21, Rodney Street, Liverpool.

1859 Randell, E. B., M.R.C.S.Eng., L.D.S.Eng. 22, Vanbrugh Park, Blackheath. S.E. (C. 1878.79.)

1889 Read, Henry G., L.R.C.P.Lond., M.R.C.S.Eng., L.S.A., L.D.S.Eng. 30, Finsbury Square. E.C.

1880 Read, Lawrence, L.D.S.Eng. 18, Hanover Street. W.

1882 Read, Thomas, L.D.S.Eng. 31, Cavendish Square. W.

1889 Read, Thos. George, L.D.S.Eng., D.M.D.Harv. 31, Cavendish Square. W.

Elected

1876 Reading, Edward. Elizabeth Street, Hyde Park, Sydney, N.S.W.

1892 Reading, Philip, Burdett, L.D.S.Eng. 197, Elizabeth Street, Hyde Park, Sydney, N.S.W.

1888 Reading, Richard Fairfax, L.R.C.P.Lond., M.R.C.S. Eng., L.D.S.Eng. 151, Marquarie Street, Sydney, N.S.W.

1866 Reboul, A. P., L.D.S.Eng. East End Road, East Finchley. N. (C. 1878.79.)

1871 Redman, J. H., L.D.S.Irel., D.D.S.Phil. 61, Old Steine, Brighton. (C. 1887.88.89. V.P. 1890.91.92.)

1890 Reinhardt, J. Hasty, L.D.S.Irel. 384, Brixton Road. S.W.

1889 Rhodes, W. A., L.D.S.I. 53, Trumpington Street, Cambridge.

1893 Richards, F. W., L.D.S.Eng. 27, Paradise Street, Birmingham.

1889 Richards, George Oliver, M.R.C.S.Eng., L.D.S.Eng. Onslow House, 9, The Green, Richmond, Surrey.

1890 Rilot, Charles F., L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. 44, Gloucester Place, Portman Square. W.

1882 Robbins, Cornelius, L.D.S.Eng. 32, Oxford Road, Kilburn. N.W. (C. 1891.92, H.S. 1893.94-95.)

1886 Roberts, Chas. Alfred, L.D.S.Eng. 19, Weymouth Street, Portland Place. W.

1878 Robertson, Andrew. 25, Castle Street, Hereford.

1876 Robinson, George. Eden Street, Oamaru, New Zealand.

1877 Rogers, Claude, M.R.C.S.Eng., L.D.S.Eng., D.M.D. Harvard. 142, Harley Street. W. (H.F.S. 1883.)

1856 Rogers, Henry, M.R.C.S Eng., L.D.S.Eng. 16, Dorset Square. N.W. (C. 1872.73.)

1863 Rogers, R., L.D.S.Irel. Alma House, Rodney Place, Cheltenham. (C. 1883.84. V.P. 1886.87.88.)

1856 Rogers, Thomas Arnold, M.R.C.S.Eng., L.D.S.Eng. 23, Endsleigh Street, Tavistock Square. W.C. (C. 1869.70.71.83.84.87. H.S. 1856.57.58.59. H.F.S. 1860. 61. V.P. 1862.63.64.79.80. P. 1865 and 81. L. 1872.73. 74.75.76.77.78. T. 1888.89.90.91.92.)

Elected

1882 Rose, Harry, L.D.S.Eng. 59, Queen Anne Street. W. (C. 1893.94-95.)

1892 Roughton, Edmund W., M.D.Lond., B.S., F.R.C.S.Eng. 33, Westbourne Terrace. W.

1890 Rouw, R. Wynne, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. 7, Wimpole Street. W.

1888 Royston, Jonathan, L.D.S.Eng. Oakfield, Huyton, near Liverpool.

1892 Rushton, Wm., L.D.S.Eng. 32, Harley Street. W.

1888 Rymer, J. F., M.R.C.S.Eng., L.D.S.Eng. 13, Old Steine, Brighton.

1863 Rymer, S. L., L.D.S.Eng. Pevensey, Wellesley Road, Croydon. (C. 1864.65.66.67. V.P. 1868.69.81. P. 1882.)

1878 Sanders, J. J. H., L.D.S.Irel. The Square, Barnstaple.

1856 Saunders, Sir Edwin, F.R.C.S.Eng. 13a, George Street, Hanover Square. W. (C. 1868.69.74.75.80.81.87.88. T. 1856.57.58.59.60. V.P. 1861.62.63. P. 1864 and 79.) (Trustee.)

1878 Saunders, Walter, L.D.S.Irel., D.D.S.Phil. Memel House, Ramsgate.

1891 Schelling, Carl, L.D.S.Eng. 7, Montpelier Row, Blackheath. S.E.

1891 Seville, John William, L.D.S.Eng. 71, Sandgate Road, Folkestone.

1893 Shiach, Gordon Reid, L.D.S.Edin. 1, North Guildry Street, Elgin.

1888 Shillcock, Jos. W., L.D.S.Irel. 1, Rue Basse, Cannes, France.

1877 Simmons, James J., L.D.S.Eng. 18, Burton Crescent. W.C.

1864 Smale, H. C., L.D.S.Eng. 118, Oxford Street, Manchester.

1880 Smale, Morton A., M.R.C.S.Eng., L.S.A., L.D.S.Eng. 22a, Cavendish Square. W. (C. 1885.86.87.92. V.P. 1893.)

Elected

1883 Smith, Alfred, L.D.S.Eng. 52, Parkhurst Road, Holloway. N.

1893 Smith, Arthur Hopewell, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S Eng. Lindum House, Boston, Lincoln.

1893 Smith, Ed. F., L.D.S.Eng. 176, Brixton Road. S.W.

1858 Smith, George W., M.R.C.S.Eng., L.D.S.Eng. 6, Aytoun Street, Manchester. (C. 1874.75.)

1863 Smith, J. A., L.D.S.Eng. 26, Eaton Terrace. S.W.

1892 Smith, J. Percy, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng. 26, Eaton Terrace, Eaton Square. S.W.

1889 Spokes, Sidney, M.R.C.S.Eng., L.D.S.Eng. and Edin. 59, Queen Anne Street, Cavendish Square. W.

1884 Stack, Richard Theo., M.D.Dub., F.R.C.S.Irel., L.R.C.S. Edin., L.D.S.Eng., D.M.D.Harvard. 10, Westland Row, Dublin. (C. 1889.90. V.P. 1891.92.93.)

1882 Sternfield, Alfred D., M.D. 3, Karlstrasse, Munich.

1888 Stevens, Alfred, L.D.S.Edin. and Irel. 11, Park Road, Clapham. S.W.

1893 Stevens, Herbert John, L.D.S.Eng. Pendeen, 77, Stamford Hill. N.

1873 Stevens, Mordaunt, M.R.C.S.Eng., L.D.S.Eng., D.D.S. Phil. Villa Corinaldi, Place Grimaldi, Nice, France. (C. 1890.91.92.)

1893 Stewart, James, L.D.S.Edin. 19, Princes Street, Perth, N.B.

1874 Stocken, James, L.D.S.Eng. 2, Mount Avenue, Ealing. W. (C. 1881.82.83. V.P. 1890.91.)

1893 Stoner, Harold, L.D.S.Eng. 6, St. Thomas's Street. S.E.

1886 Storey, J. Charles, L.D.S.Irel. Dunallan House, Hull.

1893 Sutcliffe, Charles Frederick, L.D.S.Irel. 15, Victoria Terrace, South Shields.

1877 Swanson, A. J., L.D.S.Eng. 112, Cheapside. E.C.

1892 Thomson, David, L.D.S.Edin. 15, Great Marlborough Street. W.

Elected

1881 Thomson, W. Scott, M.R.C.S.Eng., L.D.S.Eng. 19, Cavendish Place. W. (C. 1889.90.)

1871 Tippett, J. Collins. 14, Belgrave Terrace, Torquay.

1893 Tisdall, Charles J., L.D.S.Eng. 2, Heathfield Road, Acton. W.

1870 Tomes, Charles S., F.R.S., M.A.Oxon, M.R.C.S.Eng., L.D.S.Eng. 37, Cavendish Square, W. (C. 1884.85. 89.90.91. Curator 1870.71.72.73.74.75.76.77.78.79.80. V.P. 1881.82.83. P. 1887.)

1856 Tomes, Sir John, F.R.S., F.R.C.S.Eng., L.D.S.Eng. Upwood Gorse, Caterham Valley, Surrey. (C. 1864. 66.67.70.71.72. H.S. 1856.57.58. V.P. 1859.60.61. P. 1862 and 75.)

1886 Tracy, Humphrey W., L.D.S.Edin. 6, Hatter Street, Bury St. Edmunds.

1893 Trollope, William Thomas, L.D.S.Irel. High Street, Tunbridge Wells, and 17, Upper Wimpole Street. W.

1881 Truman, Chas. E., M.A.Camb., M.R.C.S.Eng., L.D.S.Eng. 23, Old Burlington Street. W. (C. 1893.94-95.)

1867 Turner, J. S., M.R.C.S.Eng., L.D.S.Eng. 12, George Street, Hanover Square. W. (C. 1873.74.78.79.80.83. 88. H.S. 1875.76.77. V.P. 1881.82. P. 1884.)

1879 Underwood, Arthur, M.R.C.S.Eng., L.D.S.Eng. 26, Wimpole Street. W. (C. 1885.86.93.94-95.)

1869 Van der Pant, F. J., L.D.S.Irel. Elm Lawn, Kingston-on-Thames. (C. 1889.90.)

1860 Walker, Joseph, M.D.St. And., M.R.C.S.Eng., L.D.S. Eng. 22, Grosvenor Street. W. (C. 1868.69.70.79.82. Ed. Trans. V.P. 1880.81. P. 1883.)

1892 Waller, Robert Edward, L.D.S.Eng. Cairo, Egypt.

1874 Wallis, C. J. Boyd, L.D.S.Eng. 23, Brook Street. W. (C. 1886.90.91.92. H.F.S. 1887. H.S. 1888.89.)

1868 Wallis, George, L.D.S.Eng. 54, Wimpole Street. W. (C. 1880.81.)

Elected

1876 Washbourne, E. Norman, L.D.S.Eng. 17, Fountains Terrace, Ripon.

1888 Watson, George W., L.D.S.Edin. 3, Walker Street, Edinburgh.

1892 Webster, Percy L., L.R.C.P.Lond., M.R.C.S.Eng., L.D.S.Eng. 26, Welbeck Street. W.

1881 Weiss, F. Henri, L.D.S.Eng. 7, Cavendish Square. W. (H.F.S. 1891.92.)

1881 Weiss, Willoughby, L.D.S.Eng. 7, Cavendish Square. W. (C. 1889.90.91. H.F.S. 1886. H.S. 1887.88.)

1874 Wells, John, L.D.S.Irel. Ringmoor Villa, Plymouth.

1863 West, C., L.D.S.Eng. 49, Finsbury Square. E.C. (C. 1876.77.)

1893 Weston, Ernest, L.D.S.Eng. High Street, Ventnor, Isle of Wight.

1876 Whatford, J. Henry, L.D.S.Eng. Elms Lea, 6, Seaside Road, Eastbourne. (C. 1885.86.87.)

1892 Wheatley, William Henry, L.D.S.Eng. and Glas. 120, Harley Street. W.

1888 White, Edward A., M.D.Aber., C.M.Aber., L.S.A.Lond., L.D.S.Edin., 1, Highbury Place. N.

1876 White, R. Wentworth, M.R.C.S.Eng., L.D.S.Eng. 26, St. Giles's Street, Norwich. (C. 1888.89.)

1870 White, T. Charters, M.R.C.S.Eng., L.D.S.Eng. 26, Belgrave Road. S.W. (C. 1874.75.80.81.82. V.P. 1884.85. P. 1886.)

1891 Whittaker, Geo. Oldham, L.D.S.Eng. King's Chambers, 26, King Street, Manchester.

1888 Williams, Hugh Lloyd, M.R.C.S.Eng., L.D.S.Eng. 45, Devonshire Street, Portland Place. W.

1881 Williamson, W. H., M.D.Aber., L.D.S.Edin., D.D.S.Phil. 15, Union Terrace, Aberdeen. (C. 1892.93.)

1874 Wilson, Andrew, L.D.S.Edin. 2, North Charlotte Street, Edinburgh. (C. 1883.84, V.P. 1885.86.87.)

1864 Wilson, G., L.D.S.Irel. 4, Whitefriar Gate, Hull.

Elected

1876 Winterbottom, Augustus, F.R.C.S.Eng., L.D.S.Eng. 16, Sloane Street. S.W. (C. 1884.85.86.)

1889 Winterbottom, Charles, M.R.C.S.Eng., L.D.S.Eng. 16, Sloane Street. S.W.

1875 Wood, Maurice D., L.D.S.Irel. Whitehall Place, Stockton-on-Tees.

1890 Wood, R. Ernest, L.D.S.Eng. 14, The Circus, Bath.

1878 Woodburn, James C., M.D.Glas., L.F.P.S.Glas. 197, Bath Street, Glasgow.

1863 Woodburn, W. S., L.D.S.Glas. 17, Carlton Place, Glasgow. (C. 1891.92.93.)

1886 Woodhouse, A. Clayton, M.R.C.S.Eng., L.D.S.Eng. 1, Hanover Square. W. (H.F.S. 1894-95.)

1856 Woodhouse, Alfred J., L.D.S.Eng. 1, Hanover Square. W. (C. 1867.68.79. V.P. 1877.78. P. 1880.) (Trustee.)

1876 Woodhouse, Robert H., M.R.C.S.Eng., L.S.A., L.D.S. Eng. 1, Hanover Square. W. (C. 1888.89.90. H.F.S. 1884. H.S. 1885.86.87. V.P. 1892.93.94-95.)

1879 Woodruff, William Herbert, L.D.S.Eng. 13, New Burlington Street. W. (C. 1889.90.91.)

1878 Woods, W. T. 25, Chowringhee, Calcutta, India.

1892 Woolf, Michael Y., L.D.S.Eng. 1, Marlborough Place, St. John's Wood. N.W.

1870 Worsley, John. 7, Fishergate Hill, Preston.

1892 Wrighton, Thomas Henry Garland, L.D.S.Eng. 7, Bloomsbury Square. W.C.

1883 Yates, Sidney Greatrex. Berkeley House, Ross, Hereford.

1863 Zinkgraf, F., L.D.S.Eng. 30, Romerstrasse, Durkheim an der Haardt Rhine, Bavaria.

List of Members

Arranged under the Heads of the Cities, Towns, &c., in which they reside.

Aberdeen.

De Lessert, A. A.
Williamson, W. H.

America.

Bogue, Edward A., New York City.
Cook, C. D., Brooklyn. (Corresponding.)
Meriam, Horatio C., Salem, Mass., U.S.A. (Corresponding.)
Stellwagen, Thos. C., Philadelphia. (Corresponding.)

Australia.

Belisario, John, Sydney. (Corresponding.)
Crank, Peter, Adelaide.
Paterson, Hugh, Sydney.
Reading, Edward, Sydney.
Reading, Philip Burdett, Sydney.
Reading, Richard Fairfax, Sydney.

Barnstaple.

Sanders, J. J. H.

Bath.

Wood, R. Ernest.

Bavaria.

Zinkgraf, F., Burkheim an der Haardt Rhine.

Bedford.

Kirby, Alex.

Berlin.

Miller, W. D. (Corresponding.)

Belfast.

Andrew, John James.

Birkenhead.

Mansell, Thomas.

Birmingham.

English, T. R. M.
Huxley, F. Earle.
Neale, W. Breward.
Richards, F. W.

Boston (Lincoln).

Smith, A. H.

Bournemouth.

Hogue, Wilson.
Merson, William.
Payne, Arthur G.

Bradford.

Matthews, A. Alexander.

Brighton.

Dennant, J.
Gabell, D. P.
Harrison, Walter.
Redman, J. H.
Rymer, J. F.

Bristol.

Ackland, William R.
Hayman, C. A.

Bury St. Edmunds.

Tracy, Humphrey W.

Cambridge.

Cunningham, George.
Rhodes, W. A.

Canada.

Beers, W. G., Quebec (Corresponding).

Canterbury.

Bell, Martin Luther.

Carlisle.

Hele, Warwick.

Caterham.

Fletcher, T. B. (Honorary.)
Tomes, Sir John.

Cheltenham.

Fernald, H. P.
Rogers, R.

Croydon.

Hughes, Morgan.
Rymer, S. L.

Darlington.

Fothergill, J. A.

Derby.

Morley, Henry.

Dewsbury.

Margetson, W. E.

Dublin.

Baker, A. W. W.
Bloom, Marcus J., Jun.
Bloom, Mark J.
Corbett, Daniel.
Corbett, Daniel, Jun.
Stack, Richard Theo.

Dundee.

Campbell, Walter.

Eastbourne.

Foran, J. C.
Huxley, Right Hon. (Honorary.)
Parkinson, J. (Honorary.)
Whatford, J. Henry.

Edinburgh.

Amoore, J. Spencer.
Durward, J. S.
Hepburn, David. (Honorary.
Macgregor, Malcolm.
Macleod, William B.
Matthew, Charles.
Orphoot, Peter.
Watson, George W.
Wilson, Andrew.

Egypt.

Waller, Robert Ed., Cairo.

Elgin.

Shiach, G. R.

Epsom.

Keeling, G. R.

Exeter.

Ackland, J. McKno.
Browne-Mason, J. T.
Goodman, W. H.
Mason, Henry B.
Mundell, Stephen.

Folkestone.

Henry, Martin.
Seville, J. W.

France.

Darin, C., Meudon. (Corresponding.)
Evans, Thos. Wm., Paris. (Corresponding.)
Magitot, E., Paris. (Corresponding.)
Poinsot, P. H. V., Paris.
Shillcock, Jos. W., Cannes.
Stevens, Mordaunt, Nice.

Glasgow.

Agnew, Joseph.
Brownlie, J. R.
Fergus, Oswald.
Price, Rees.
Woodburn, James C.
Woodburn, W. S.

Great Grimsby.

Howkins, T. M.

Guildford.

Hope, A. C.
Hope, H. L. C.

Guernsey.

Hugo, George Joseph.
Hugo, Samuel George Joseph.

Hanley.

Baines, A.

Harrogate.

Martin, Gavin W.

Hastings.

Henry, George.

Hereford.

Levason, Arthur G.
Levason, Peyton Grenville.
McAdam, George C.
Robertson, Andrew.

Hull.

Storey, J. Charles.
Wilson, G.

Hungary.

Arkövy, Dr. T., Budapest.

India.

Clerk, Smollett W., Madras.
Gould, Horace J., Madras.
O'Meara, Alfred, Simla.
Woods, W. T., Calcutta.

Inverness.

Fraser, J. L.
Grant, W.

Ipswich.

Cole, J. F.

Isle of Man.

Karran, J., Douglas.

Italy.

Atkinson, S., Commre., Naples.
Dunn, C. W., Florence (Honorary.)
Martini, Luigi, Turin.

Jersey.

Balcomb, Thos.

Kingston-on-Thames.

Van der Pant, F. J.

Leeds.

Brunton, George.
Carter, T. S.

Leigh, Essex.

Murie, J. (Honorary).

Leicester.

McCall, John H.

Liverpool.

Matthews, William.
Quinby, Henry Clay.
Quinby, Melville G. C.
Royston, Jonathan.

London.

Ackery, John.
Albert, Henry L.
Apperly, Ebenezer.
Apperly, Herbert.
Badcock, J. W.
Bailey, G. H. (Honorary.)
Balding, Edmund, Jun.
Baldwin, Harry.
Baly, C. F. P.
Barnard, Alfred Geo. Wm.
Barrett, Ashley William.
Barrett, F. W.
Barrett, H. J. (Honorary.)
Bartlett, Edward.
Bateman, George William.
Beale, Lionel S. (Honorary.)
Bennett, Fred. Jos.
Bennett, Storer.
Betts, Ed. G.
Bird, Tom. (Honorary.)
Bonnell, Bentley J.
Braine, F. Woodhouse. (Honorary.)
Briault, E. H. L.
Butcher, J. O.
Buxton, Dudley W. (Honorary.)
Canton, Frederick.
Canton, Fred Arthur.

Carteighe, John, Jun.
Cartwright, Alexander.
Clarence, J. H.
Clark, C. A.
Coffin, Walter.
Coleman, Alfred. (Honorary.)
Colyer, Arthur R.
Colyer, J. F.
Cook, Stanley.
Corbett, J. F.
Cotterell, Chas. Vincent.
Curnock, George Dennis.
Davis, Charles D.
Davis, Henry.
Davis, Marcus John.
Davis, Murray.
Dewes, Hugh William.
Dowsett, George Harris.
Edgelow, J. Percy.
England, W. J.
Ewbank, Francis.
Fairbank, John.
Field, W. George.
Finzi, S. L.
Fisk, W. J.
Flower, Sir William. (Honorary.)
Forsyth, Harry A.
Forsyth, W. F.
Fripp, Trude.
Gabell, Ernest.
Gardner, Ernest.
Gartley, John A.
Gibbings, Ashley.
Gill, H. B.
Greenfield, J.
Gregson, G.
Halliday, Middleton W.
Handley, C. W. Croft.
Harding, Milward.
Harding, T. Henry G.
Harris, A. Carpenter.
Harris, J. E.
Harris, T. W.
Harrison, Richard.
Hayward, H. S.
Heath, Christopher (Honorary).
Hepburn, David.
Hepburn, Robert. (Honorary.)
Hern, George.
Hern, William.
Holford, W. Stanley.
Hooper, G.
Hopson, Montagu F.
Humby, W. R.
Hutchinson, S. J.
Ibbetson, George A. (Honorary.)
Imrie, William. (Honorary.)
Kendall, W. H.
Kissack, Frank H.
Kluht, Henry J.
Lechmere, F.
Lloyd-Williams, E.
Longhurst, Henry Bell.
Maggs, W. A.
Mansbridge, Josiah.
Matheson, Leonard.
May, Percy.
Merson, James.
Messenger, Henry W.
Mitchell, F. W.
Mitchell, Wm.
Mummery, John Howard.
Newland-Pedley, F.
Newton, Fredk. Harriss.
Noble, Chas. J.
Northcroft, George.
Paget, Sir James. (Honorary.)
Parkinson, Herbert S.
Parks, William J.
Paterson, W. Bromfield.
Pedley, George.
Pedley, R. Denison.
Penfold, W.
Porter, W. P.
Pratt, R. J. H.
Preedy, E. J.
Randell, E. B.
Read, Henry G.
Read, Lawrence.
Read, Thomas.
Read, Thomas George.
Reboul, A. P.
Reinhardt, J. H.
Richardson, Sir B. (Honorary.)
Rilot, Charles F.
Robbins, Cornelius.
Roberts, Charles Alfred.

Rogers, Claude.
Rogers, Henry.
Rogers, Thomas Arnold.
Rose, Harry.
Roughton, Edmund W.
Rouw, Robt. Wynne.
Rushton, Wm.
Saunders, Sir Edwin.
Savory, Sir Wm. (Honorary.)
Schelling, Carl.
Simmons, James J.
Smale, Morton A.
Smith, Alfred.
Smith, E. F.
Smith, J. A.
Smith, J. Percy.
Spokes, Sidney.
Stevens, Alfred.
Stevens, H. J.
Stocken, James.
Stoner, Harold.
Sutton, John B. (Honorary.)
Swanson, A. J.
Thomson, David.
Thomson, W. Scott.
Tisdall, C. J.
Tomes, Charles S.
Trollope, W. T.
Truman, Charles E.
Turner, J. S.
Underwood, Arthur S.
Underwood, Thomas (Honorary.)
Walker, Joseph.
Wallis, C. J. Boyd.
Wallis, George.
Webster, Percy L.
Weiss, F. Henri.
Weiss, Willoughby.
West, C.
Wheatley, William Henry.
White, Edward A.
White, T. Charters.
Williams, H. Lloyd.
Winterbottom, Augustus.
Winterbottom, Charles.
Woodhouse, A. Clayton.
Woodhouse, Alfred J.
Woodhouse, Robert H.
Woodruff, William Herbert.
Woolf, Michael Y.
Wrighton, Thos. H. Garland.

Macclesfield.

Bates, W.

Maidenhead.

Ghrimes, S. (Honorary.)
Pallant, Arthur.

Manchester.

Campion, Geo. G.
Campion, H.
Farnsworth, Charles.
Smale, H. C.
Smith, George W.
Whittaker, Geo. O.

Munich.

Sternfeld, Alfred D.

Newark.

King, R. F. H.

Newbury.

Mallet, Gilbert.

Newcastle-on-Tyne.

Fothergill, Edward.
Markham, R. L.
Moon, Wm. Draper.

New Zealand.

Cox, Edwin, Auckland.
Robinson, George, Oamaru.

Northfleet.

Lucas, George.

Norwich.

Bridgman, J. B.
White, R. Wentworth.

Nottingham.

Bellaby, G. W.
Goddard, H. E.

Oxford.

Bevers, Edm. Aug.

Perth.

Stewart, James.

Peterboro'.

Palmer, James Edwin.

Plymouth.

Balkwill, F. H.
Jewers, Ernest E.
Wells, John.

Portsmouth.

Baker, Alfred J.
Martin, J. H. C.

Preston.

Worsley, John.

Ramsgate.

Saunders, Walter.

Reading.

Knowles, Vernon.

Redhill, Surrey.

Ellwood, Fras. Henry.

Richmond, Surrey.

Davis, Harry.
Richards, George Oliver.

Ripon.

Washbourne, E. Norman.

Ross, Hereford.

Yates, Sidney Greatrex.

Salisbury.

Farebrother, H. Lloyd.

Scarborough.

Grayston, William Cass.
Mason, Charles Browne.

Sheffield.

Pike, J. L. F.

Shrewsbury.

Harding, Wm. E.

South Molton.

Merson, Frank.

South Shields.

Sutcliffe, C. F.

St. Leonard's.

Amoore, D. W.
Dickinson, M. de C.

Stirling.

Platt, Leon J.

Stockton-on-Tees.

Wood, Maurice D.

Stroud.

Apperly, Ebenezer (and London).

Surbiton.

James, W. E.

Switzerland.

Kölliker, Paul Alfred, Zurich (Corresponding.)

Taunton.

Blain, E. J.
Kendrick, Alfred.

Tonbridge.

Coles, J. Oakley. (Honorary.)

Torquay.

Briggs, F. H.
Tippett, J. Collins.

Tunbridge Wells.

Bacon, W. Beadell.
Trollope, Wm. Thos. (and London).

Ventnor.

Weston, Ernest.

Walton-on-Thames.

Power, Thos. Henry.

Wisbech.

Coxon, Stephen A.

Worthing.

Cooksey, E. T.

Yarmouth, Gt.

Cobb, John S.

Yeovil.

Hunt, William A.

York.

Glaisby, Walter.
King, Thos. Edward.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

November 6, 1893.

MR. ROBERT WOODHOUSE, M.R.C.S., L.D.S.,

VICE-PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

The following gentlemen signed the Obligation Book and were formally admitted as Members by the Chairman :— Messrs. H. L. BRIAULT, C. J. TISDALL, G. NORTHCROFT, E. F. SMITH, and H. J. STEVENS.

The CHAIRMAN announced that he had received Obligation Forms, duly signed, from the following gentlemen :— RICHARDS, F. W., of Birmingham ; SHIACH, G. R., of Elgin ; and he declared them admitted as Non-Resident Members of the Society.

Mr. CHARLES FREDERICK SUTCLIFFE, L.D.S.Irel., of 15, Victoria Terrace, South Shields, was balloted for and elected a Non-Resident Member.

The LIBRARIAN reported that since the last meeting the following books had been presented to the Library by their authors :—" Diseases and Injuries of the Teeth," by Messrs.

Morton Smale and J. F. Colyer; "Anæsthetics and their Administration," by Dr. Frederic Hewitt, and "Des Fistules d'Origine Dentaire," by M. Camille Tellier, of Paris, and that the following books, &c., had also been received:—*The Journal of Anatomy and Physiology, The Journal of Bacteriology, Guy's Hospital Reports*, "Calendar of the Royal College of Surgeons," and the usual journals.

Mr. Stanley Boyd reported a "Case of Resection of the Symphysis of the Lower Jaw," the parts being retained in position by the insertion of a bar of silver wire. He said the patient was a woman, aged 61; she was married, and had never been pregnant. There was nothing in the family history throwing any light upon the case. There was no history of syphilis; she had always been perfectly temperate, and had worn dentures for many years, the lower ultimately inducing an epithelioma. The mouth had always been tender. The clinical interest of the case depended upon the facts that she had had extensive leukoplakia on the tongue for fourteen years. She could never eat hot food or drink spirits, but in spite of being unable to eat or drink these things she had developed leukoplakia, which was regarded as being often dependent upon such practices. For fourteen years she had had these patches on her tongue, which had always been very sore, and they gradually spread over the anterior two-thirds of the dorsum; potash tablets seemed to relieve the soreness. Thirteen years ago all her teeth became loose, and fell out one after another; she never had any prolonged illness, nor was it preceded by any illness, but simply the teeth became loosened one after the other and all dropped out. That would be before she was 50 years of age. Three or four months ago one of the leukoplakial patches on the dorsum of the tongue developed into an epithelioma on the right side. About six weeks ago she noticed that her lower plate hurt her just behind the jaw, and she found a white-surfaced, warty growth in the hollow between the frænum and the jaw, creeping on to the lip. This was the more extensive epithelioma of the two, and possibly had been in existence before the one on the

dorsum of the tongue. When she came to Charing Cross Hospital there were leukoplakial patches over two-thirds of the tongue, with a round-edged epitheliomatous ulcer on the right side of the dorsum of tongue. It did not infiltrate to any extent, so that the movements of the tongue were quite free; but underneath the tongue, between the frænum and the jaw, there was an epithelioma which infiltrated deeply; it inhibited the movements of the tongue in that region to a certain extent, and so firmly bound it to the symphysis menti that, with a finger inside and another outside and underneath, the mass could not be moved apart from the jaw, and the sub-mental gland could not be felt. It could not, therefore, be said whether it was enlarged, though it was likely that it would be. There were no enlarged glands in the sub-maxillary region that could be felt, but there was some tenderness in those regions. She was toothless. There were no enlarged parotid glands. With regard to the operation, Mr. Boyd cleared out, as a matter of principle, both sub-maxillary regions through the curved incisions usual in ligature of the lingual. The glands were cleared out, although they could not be felt. Even if there had not been the evidence of tenderness he believed that that ought to be done. The curved incisions were made to meet behind the symphysis of the jaw, and there he was able to get at the sub-mental glands and clear them out. The single incision now ran up through the lip; the soft parts were stripped back rapidly from the jaw as far as the bicuspid regions. The jaw was then sawn through, and the whole symphysis removed; the epithelioma, the floor of the mouth, and the anterior half of the tongue were removed, and also the sub-mental gland. A spanner of silver wire was then inserted (and this was the point that he wished particularly to bring forward) from one side of the jaw to the other, simply drilling a hole with an ordinary bradawl backwards into the jaw, and bending the wire so that it ran in along the length of the jaw. Thus any pressure exercised by the skin and scar contraction upon the wire bridge would tend only to drive the wire further into the jaw. There was, of course, contraction from side to side, and it might be the resistance

of the wire would force it out, but it would be a very long time before that would happen. Probably the slight irritation would simply cause thickening of the bone. He was able also to use the spanner to tie the tongue to, putting a ligature through the front of the tongue and tying it on to the wire. That held it in position, and during the time when there was danger of the tongue dropping back on account of the division of the genio-glossi and genio-hyo-glossi, this suture acted in their stead. The wound healed well; the only result complained of was that owing to lack of epithelium in the anterior half of the floor of the mouth, scar contraction had gone on, and the upper lip dropped over the lower; but on raising it and looking at it from the side, it showed a very fairly shaped chin of remarkable firmness.

Mr. Stanley Boyd also mentioned an operation performed on a man on the previous Saturday, in which two spanners were used, so as to deepen the chin and still further hold the lip up, and he hoped by that means not to have so much dropping back of the lip, although in that case also he had had to remove the floor of the mouth very freely owing to recurrent epithelioma.

Mr. S. J. Hutchinson asked how long the wire had been in its position in the first case mentioned.

Mr. Stanley Boyd said five weeks. It was quite buried.

Mr. Hutchinson said with regard to fixing a denture Mr. Stanley Boyd had demonstrated how very simple it was to put in this silver wire, and how well it had resigned itself to its circumstances. He suggested whether that step might not be carried a little further, and by making a denture with two silver wires projecting at each end it could be inserted in the bradawl holes in the jaw itself and thus the whole thing be held in place as a permanent fixture to keep the lower lip from being contracted and the ends of the bone from coming together. Of course, this was a very experimental process, but seeing that the silver wires remained there without causing any irritation, he

saw no reason why a vulcanite plate with two silver wires projecting from the ends could not be equally well embedded into the projecting ends of the bone. The result of the case exhibited was extremely satisfactory, and the Society was very much indebted to Mr. Stanley Boyd for bringing it before them. The tongue was tied with a silver wire as a subsequent part of the operation, and he suggested that the addition of a vulcanite plate would be a still further elaboration of the very successful operation which had been performed.

Mr. Paterson asked Mr. Boyd if he would kindly inform them as to the result of the case that he had brought forward last year, in which use had been made of a knitting needle. He had seen two cases of treatment of resection of the jaw in the way Mr. Stanley Boyd had described, without the use of any spanner at all, and of course the result was deplorable. The jaw came together in the middle line like a V, and if there was any anchylosis following it was absolutely beyond all treatment. He asked whether there was some possible necrosis in the present case, for he had noticed just a suspicion of crepitus.

Mr. Stanley Boyd said with regard to the case brought forward last year, the knitting needle was not put in with the intention of keeping it *in situ*, but simply until the denture could be fitted. The girl always had pain, and he therefore endeavoured to take it out, but could not find it, probably because it had been loosened from the jaw and was surrounded by tense tissue in which it could not be felt. The girl, however, thought that he had taken it out, and was quite happy afterwards. She had a recurrence, and then he cut out the recurrence *plus* the needle, the needle being just black. With regard to the crepitus mentioned by Mr. Paterson, he (Mr. Stanley Boyd) certainly had not noticed it. He did not think there was any necrosis, and certainly hoped there was not.

Note.—Nov. 25. The patient has lately been examined under chloroform and the jaw manipulated freely, a gag being used on both sides. The wire was quite firm.—S. B.

Mr. Arbuthnot Lane brought forward a case of "Anchylosis of the left Temporo-maxillary Articulation with dwarfing of the Lower Jaw." The patient was in attendance, and models of the mouth were shown. The girl was 13 years old; when she was 2 years old she got a sting on her cheek. Some diffuse cellulitis followed, and from that time she was unable to move the jaw, which had been absolutely fixed ever since she was 2 years old. He found her in the Hospital for Sick Children, in the condition described, and later she was admitted into Guy's Hospital. The lower jaw was extremely undeveloped; the lower incisors were biting almost against the roof of the mouth, and there was no movement of any sort in the jaw. The left temporo-maxillary articulation was the only one affected. After the removal of a large portion of the condyle of the jaw, he was able to get a certain amount of movement. During the operation a hasty tracheotomy had to be performed as the breathing failed, and the mouth being closed, it was impossible to bring forward the tongue. Mr. Maggs saw the case and asked him to show it to the Society. He was rather in a difficulty as to the wisest course to be pursued. Two methods occurred to him, one being to cut across the ramus on both sides, to slide the lower jaw forward, and fix it with a couple of steel screws. Then, on the other hand, he thought of cutting the body of the jaw vertically on either side of the canine teeth, bringing it forward a quarter of an inch, sloping it, and fixing it with steel screws. He was looking forward with much interest to some suggestions on the matter.

Mr. W. A. Maggs said he had an opportunity of seeing the patient before and after the operation, and, as had been stated, there had been absolute fixation of the jaw from 2 years of age. The patient was only able to take food by passing it between the lower incisors and the palate, a slight space intervening. One of the causes of anterior protrusion of the upper incisor teeth was excessive development of bone in the pre-maxillary region, but in this instance a similar condition had been brought about by

arrest of development of the lower jaw, and the effect of pressure in feeding, which latter had also caused flattening of the lower incisors. The faulty development of the lower jaw suggested by its appearance a want of mental development on the part of the child, but he was told that this was not so. With regard to the teeth, it was interesting to know their condition, inasmuch as they had never been used, properly cleaned, or indeed treated in any way. All the permanent teeth were erupted, excepting the left upper canine, and all the second and third molars. Several of them were carious interstitially, notably the upper incisors and one of the lower. The first permanent molars, too, were decayed in the lower jaw to the level of the gum, so that when the jaw was fixed it was impossible to say that they were erupted at all. The result of the operation was, to his mind, very satisfactory, although he hoped that a little more space between the teeth would be gained in due time. With regard to the further treatment, he did not like to express any opinion because he had not the least doubt that either of the methods suggested by Mr. Lane would still further benefit the patient. The only thing he would suggest was, whether pushing out the lower incisors, and drawing inwards the upper, as is done in regulation cases, might not effect the same purpose, although at a much slower rate. It would be very interesting to follow the case, and also to know from Mr. Lane whether he thought the lower jaw would become more developed with use, or whether it had attained its full development, even though in the future she might probably have the free use of the jaw.

The Secretary showed a rubber-dam holder sent by the President, and read the following description which accompanied it:—

"This rubber-dam holder is intended to hold back the free margins of the rubber, and at the same time to keep the rubber 'taut' in a vertical direction. It consists of a central flexible shaft, to each end of which is fixed a finger and thumb device. The arm or shaft is a spiral coil, such

as we are familiar with in the dental burring engine (but might be made of other flexible material, such as whalebone); it is four inches long. The finger and thumb device is a narrow strip of metal, bent upon itself near the centre, and forming a short upper limb, representing the thumb, and a longer under limb, representing the forefinger. Attached to the shorter limb by a hinge joint is a flange, on the lower side of which is an eccentric cylinder or roller, which on being depressed dips into a slot on the under limb, and grips and holds tight the rubber without danger of tearing it.

"This holder will, I think, be found useful in all cases; specially useful in the application of the coffer-dam to teeth in the lower jaw; easy of attachment; comfortable in adaptation to the cheek; capable of stretching the rubber without straining it; and being readily applied with the finger-clamps at any angle will, I hope, prove itself a welcome means of securing more light and freedom of action in molar cavities than we have hitherto enjoyed in using any of the rubber-dam holders at present on the market."

Some Observations on the Cellular Elements of the Dental Pulp.

By A. Hopewell Smith, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S.Eng.

Mr. President and Gentlemen,—It is my desire to-night to bring before your notice the result of several years' work in investigating and studying the morphology and physiological properties of the cellular elements of the dental pulp.

This is done with no great wish to principally inculcate my own opinions, but to provoke a good discussion, to open up new side-ways of thought and conjecture for the purposes of research, and to arrive at some satisfactory and trustworthy idea of these all-attractive yet somewhat abstruse questions. My statements, I trust, will be more argumentative than dictatorial, more suggestive than dogmatic; for histology is an exact science, and it is needful for many observations to be made and recorded by many original workers who are able to adduce corroborative testimony, ere a hypothetical suggestion finds a solid basis in actual fact, or a doubt be resolved into an accepted truth. It is extremely easy to advance a

new theory, but it is often difficult to prove it. An attempt, however, will now be made, by means of logical reasoning and theoretical inference, to clear up some debatable points, and elucidate some still obscure matters in connection with the histology and physiology of the cells of the dental pulp. And the production of this paper is due to the earnest belief in the reasonableness and accuracy of the views contained therein. Necessarily much that is already well known on the subject must be mentioned, but there are various new points which can lay claim to a considerable amount of originality.

Of all the structures which are noticed on the microscopic examination of a tooth, the dental pulp is the one around which the greatest interest is centred. For not only is it of vital importance to the surrounding tissues during the developmental and completed periods of growth, as well as under certain senile and pathological conditions, but it contains elements which differ markedly from any other in dentine, enamel, cementum, or periosteum. While it thus occupies first place with regard to interest, it is curious to note that so little new has, of late years, been added to its recorded histology and patho-histology; and that our knowledge, after all, is so very limited. One has but to look back and recall the names of Foubard, Hoffmann, Boll,

Waldeyer, Goodsir, Schwann, Kölliker, and later of Tomes, Mummery, Underwood, and Weil, to find that the subject has commanded almost universal attention. Still, who can say what are the exact terminations of the nerves? or who shall speak definitely as to the precise nature and functions of the cells of the pulp? But each mite of fresh information contributed by each individual observer, goes to make up a larger knowledge, and pave the way to a completer science, when it has passed through the stern fires of criticism.

The cells of the dental pulp fall naturally into two classes: of these, the first is the more important during the life of a tooth, the second during its formation. A cursory examination shows that two kinds of cells stand out clearly distinct from each other—the peripheral prominent layer of cells, the so-called odontoblasts, and the central smaller, less defined pulp cells.

In order systematically to discuss these points, the paper will be divided into the consideration of

(A) Cells of the Membrana Eboris { (i.) Their histology. (ii.) Their physiology. { (α) Negative evidences. (β) Positive evidences.

(B) Cells of the Pulp Proper { (i.) Their morphology. (ii.) Their physiology.

A.—The Cells of the Membrana Eboris.

(1) *Their Histology.*

All along the periphery of a section of the pulp, arranged like a palisade, in a single row, is a layer of large, columnar epitheloid cells. This layer is most marked at the coronal portion of the pulp, and becomes appreciably less distinct at the cervical portion; while in the region of the root it is practically invisible. These facts are clearly seen in the developing teeth of kittens (plate ii. fig. 3) and other embryos, as well as in complete central longitudinal sections of adult human pulps, although in the latter, their columnar character has disappeared. In transverse sections, too, it is not difficult to say with accuracy from which portion of the pulp the particular section has been taken, if this layer is visible. A closer inspection reveals the fact that the membrana eboris is composed of cells—the so-called odontoblasts, a term suggested by Waldeyer in 1870, and generally adopted since that time. In young pulps, it consists of a single row of cells; in adult specimens, several rows. These cells are of the utmost interest and importance. They will be described with regard to shape, size, relationships, structure, processes and analogies.

(1) An odontoblast, generally speaking, is

a large multipolar, nucleated, epitheloid cell, more or less columnar in *shape*. This varies considerably in the same specimen, and ranges from that of a mere thin cord with bulbar terminations, to that of a pear or banana, as Mr. Underwood[1] has recently likened it. Many cells are carrot shaped, many caudate. Some are short and thick, some long and thin; some have, as is well known, square dentinal ends, others rounded extremities. But it would appear that those found in fully grown pulps are more or less pyriform in shape, while those in older specimens are reduced often to a thin fibrous bundle. A point worthy of notice is the fact that cells in the same plane—the same section—differ much in conformation. Where the pulp is constricted or flattened laterally, there the odontoblasts are thick and short; in the place where the pulp is broadest, however, they are long and thin. Moreover, in the latter situation, in adult pulps, they have enlarged extremities, that near the dentine sometimes presenting a stellate appearance, with the processes leaving the cell from the point of the star. Often this dentinal extremity is triangular, often rounded. The central portion or body of the cell is very considerably thinned and cordlike (plate ii., fig. 4). In teeth having

[1] "Aids to Dental Histology," 1892, p. 15.

cylindrical pulp cavities, this diversity in the shape of these cells is scarcely appreciable, and probably does not exist.

It may be said that the same remarks apply also to fully-formed temporary teeth.

Pathological conditions, such as inflammation of the pulp, abscess and calcareous degenerations do not seem to affect the shape of the odontoblasts at first; this rule obtains in all normal and abnormal examples.

(2) With regard to *size*, odontoblasts vary very considerably, the coronal cells being larger and more marked than the radical cells of the pulp. This change in size corresponds to the length and width of the tubules, with which they are closely associated. The largest cells in an embryonic tooth-germ (fig. 3), viz., those under that part of the dentine which is covered with enamel, and called for sake of brevity the coronal part of the pulp, have a diameter of 10 to 15 μ, and if they be compared to adult cells in the same situation, the latter will be found to vary from 25 to 30 μ in length with a breadth of about 5 μ. Waldeyer[2] gives the size of adult odontoblasts, but does not compare them with developing cells—a point of importance which seems to have been overlooked.

(3) *Relationships to Surrounding Structures.*—

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[2] Stricker's "Histology," 1870. vol. i., p. 476,

I[3] have in a paper written in 1889—to which I may perhaps be allowed again to refer—already shown that these cells are not packed closely together, but are separated by wide visible spaces, which are in certain cases filled with a "homogeneous substance, and small, round, and angular cells." I will only add that this is the case in developmental pulps, there being an absence of inter-cellular tissue in most adult specimens; and I will further remark that there are visible also in many instances, fine delicate fibrils stretching into the dentine between the odontoblasts, in addition to the already-mentioned structures. As far as my research goes, these fibres are not nerves, but form what may be termed the "supporting fibres" of the pulp. Reference to this point will again be made later on.

The long axes of the odontoblasts are approximately in the same direction as that of the tubules—a fact well brought out in transverse sections of pulp cut *in situ*, and best observed in its narrowest part.

(4) In *structure* the odontoblasts possess a fine degree of granularity, which does not disappear on the addition of a weak acid, and is apparently unaffected by glycerine, and certain other chemical re-agents. Their nuclei are large and

[3] *Dental Record*, vol ix., No. 8.

DESCRIPTION OF FIGURES.

PLATE I.

FIG. 1.—Odontoblasts *in situ*. Transverse section of adult canine of man. The photograph was taken at the broadest part of the cervical region of the pulp. The cells show their stellate or triangular extremities with their peripheral processes entering the dentinal tubules, in which they run irregularly. Their lateral processes and basal poles are not brought out in the figure.—*Mag.*, 750.

FIG. 2.—Longitudinal section of adult pulp *in situ* at apical region of root. Shows the absence of odontoblasts coinciding with absence of dentinal tubules. Shows also the insignificant character of the former.—*Mag.*, 500.

PLATE I.

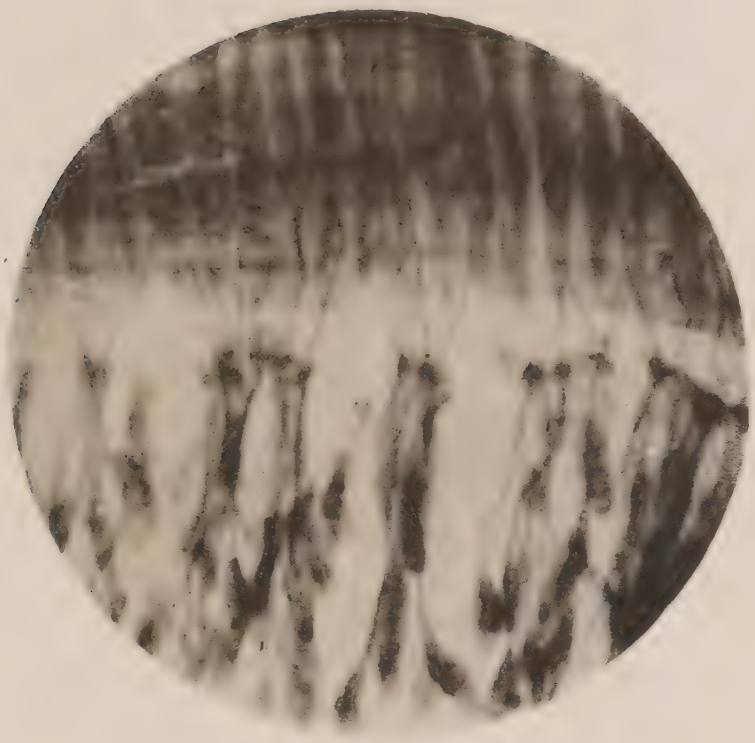

Fig. 1. $\frac{750}{1}$

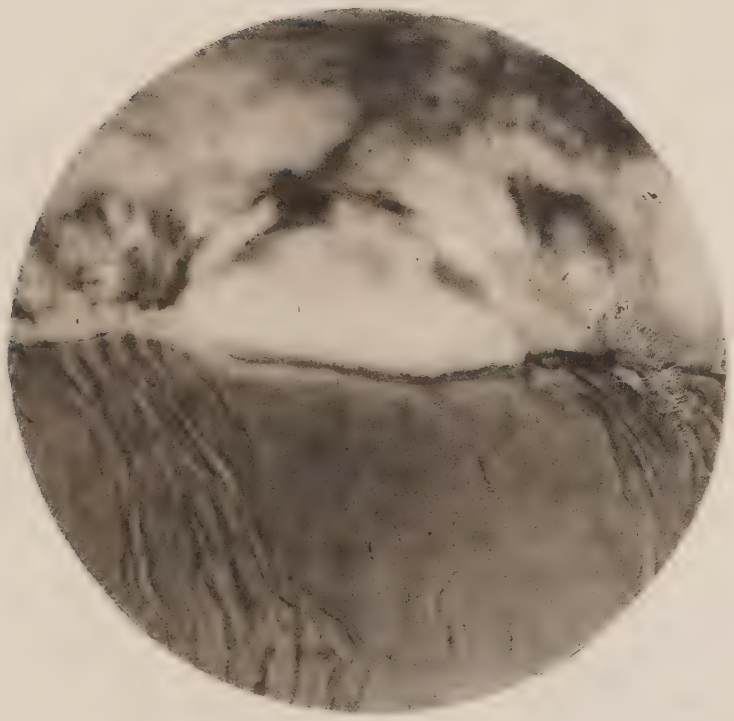

Fig. 2. $\frac{500}{1}$

prominent, and situated at their basal extremities. It is said that they have no limiting membrane.

(5) The *processes.*—These cells are remarkable for their polar offshoots, which may be classified as (α) central or basal ; (β) peripheral or dentinal, and (γ) median or inter-cellular (fig. 5).

Of these, the first named are most easily observed in sections prepared by Weil's or Decalcifying processes, when ordinary stains are used, but the latter cannot be so clearly demonstrated unless, as Mr. Mummery has suggested, a special method of staining with iron and tannic acid is adopted. Rubin and a few other anilin dyes show them also.

The peripheral poles of the odontoblasts, then, stretch into and enter the tubules of the dentine, and are here called dentinal fibrils. In some cases they are bifurcated, several fibrils emanate from one cell, and nothing else can be seen entering the tubule.

The median or inter-cellular poles are short and extremely thin, and are situated near the dentinal extremity of the odontoblast. They probably serve merely to support and bind together the component parts of the membrana eboris.

It is no easy task to demonstrate the basal offshoots of the odontoblasts. They are very thin and long, and inter-communicate with each

other and those of neighbouring cells in such a manner as to form a delicate reticulum. They present no varicosities of surface, are not swollen or twisted, and take the stain less deeply than other portions of the pulp tissue. They are invisible in young developmental cells.

Weil,[4] in his monograph on the Dental Pulp, has pointed out that this layer of processes is like a basement membrane. He writes: "The layer contains no cellular elements or nuclei, it appears rather as a web of extremely fine fibrils, which do not run perpendicularly through the layer, but running obliquely towards the deeper layers, interlace with one another in a crosswise direction. . . . It may be said with perfect security that they arise from the projecting basal ends of the odontoblasts. It is, however, surprising that these offshoots do not follow the axial directions of the odontoblasts, but turn sideways to one direction or another, and thus form the crossings."

There remains the significant fact that this basal layer of Weil's, composed, as we have seen, for the most part, of the central processes of these cells, measures at the coronal portion of the pulp $\frac{1}{40}$ mm. in diameter, gradually thins away and becomes diminished in size, until it no longer exists in the radical part of the pulp. This

[4] "Zur Histologie der Zahnpulpa," Leipzig, 1887, p. 55.

statement, corroborated by Partsch,[5] of Breslau, deserves great attention, as will be presently shown.

Further, Mr. Mummery[6] refers largely to this in a recent paper where he says : " According to my experience the layer is not visible in young teeth in the situation of the rapidly depositing dentine at the open, uncompleted end of the root."

This is what one expects to find if Weil's statement is correct. I may say here, that my own slides bear out Mr. Mummery's remarks ; for not only is Weil's layer visible in adult, and in temporary pulps, but I have met with it in certain pathological conditions, although I have never seen it in young growing teeth.

Special stainings, such as Weigert's, Golgi's or Stroebe's have failed, however, up to the present to trace back these central poles to the terminations of the nerves of the pulp ; but there can be little doubt that they are continuous.

(6) Lastly, there is a marked *analogy* existing between the odontoblasts and certain epitheloid cells found in the olfactory region of man and animals, in the ganglionic layer of the retina, and the auditory cells of the macula lutea of the

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[5] *Deutsche Monatsschrift fur Zahnheilkunde,* Aug., 1892, p. 322.

[6] *Journal of Brit. Dent. Assoc.*, 1892, p. 779.

membranous labyrinth. Their processes are similar, their structure identical, their shape only modified by the mutual apposition of neighbouring cells.

(2) *Their Physiology.*

The questions relative to the functions and uses of the odontoblasts are deep and intricate, and for years have been the subject of earnest inquiry. Their small size, delicate nature, and inaccessibility have rendered microscopic investigations difficult, and many theories as to their properties have been brought forward.

It will be helpful, for a clear comprehension of what is to follow, to briefly enumerate these various opinions. Mr. Tomes,[7] and with him the majority of English observers, believed in the conversion theory of the formation of dentine. The cells undergo changes and become converted into matrix, sheath and fibril. Quite lately, however, Mr. Tomes has spoken on this point with a large amount of uncertainty. At Birmingham in 1893, he remarked,[8] "We have always been accustomed to say that they [the odontoblasts] formed the whole of the dentine; now we know that they do not."

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[7] "Dental Anatomy," 1889, p. 170.

[8] *Jour. of Brit. Dent. Assoc.*, vol. xiv., p. 474.

Again, many histologists, including Magitot, Kölliker, &c., hold to the secretion theory, maintaining that matrix is secreted from these cells.

Klein[9] leans to the belief that the odontoblasts form matrix only, while the fibrils are not their processes, but stretch out from a deeper layer of cells. A section of pulp cut *in situ* shows clearly their processes extending into the tubules. This will be seen in a photograph presently to be thrown on the screen (plate i., fig. 1). In addition, there is the theory of Heitzmann and Bödecker, lately apparently corroborated by Abbot of New York.[10] Here the odontoblasts are said to be first broken up into "medullary corpuscles" at their distal ends, which become infiltrated first with a glue-yielding basis substance, and afterwards with lime-salts. Thus many conflicting views exist.

The axiom that dentinal fibrils are considered to be sensation conductors is well known to all. Inasmuch, then, as they are regarded functionally in the light of nerves, and as they represent the peripheral poles of the odontoblasts, and are, in fact, part and parcel of those cells, it follows that the latter must be concerned in the act of conveying extrinsic stimuli to the nerves of the pulp.

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[9] "Atlas of Histology," 1880, p. 185.
[10] *Dental Cosmos*, Sept., 1893, p. 821.

An odontoblast is more of a sensation transmitter than a sensation generator. In other words, it is believed to be a means of communication between fibril and nerve ending—not originating, but passing on sensory impulses from without in, and warning the pulp, so to speak, of incoming dangers. This seems to me a sensible argument, and this is my theory.

In order to prove this, it is necessary to show (1) that odontoblasts do not form dentine, as is generally understood; (2) to prove that they are the end organs of the nerve filaments of the pulp.

Negative Evidences.

The arguments to disprove the dentine-forming theory are many and powerful. They are as follow:—

(1) No observer has ever seen a semi-calcified odontoblast, or recorded the observation of one secreting a calcareous material, although this has been done over and over again with regard to the ameloblasts of the enamel organ, as Mr. Tomes[11] has demonstrated.

(2) The same cell cannot take on two totally different functions simultaneously. In general histology it is found that complex, branched, ganglionic corpuscles exist in the nervous

[11] *Op. cit.*, p. 162-3.

system, while very simple cells—osteoblasts—produce the matrix of bone. There must be a separate cell for the formation of fibril and matrix.

(3) The presence of spaces between odontoblasts would lead one to expect to find like spaces in dentine, but this is not so. *Per contra*, active osteoblasts *are* closely packed together.

(4) As fibrils and their sheaths are known to cross interglobular spaces, and as the latter are considered to be an arrest of dentinal development, one would expect that if the fibrils were formed by the same agents as those which produced matrix, they themselves (fibrils) would be absent, but this is not so.

(5) Again, in the semi-calcified matrix observed in developmental pulps, fibrils are seen most clearly to stretch across the intervening zone, and there is a distinct mark of demarcation between them and the homogeneous substance through which they extend.

(6) The granularity of the cells, as has been already stated, is visibly unaffected by dilute acids or chemical reagents; thus it would seem that calcium salts enter but little into their composition.

(7) After decalcification in formic acid, the matrix may be torn into laminæ, which run parallel to the surface of the pulp cavity,

PLATE II.

FIG. 3.—Complete central longitudinal section of developing temporary tooth of pig. Shows *in situ* the layer of odontoblasts which are marked at the coronal and cervical regions of the pulp, but are imperceptible at its radical portion.—*Mag.*, 25.

FIG. 4.—Transverse section of adult canine of man with pulp *in situ*. Shows the general appearance of odontoblasts at the broadest part of the pulp, their wide intercellular spaces, and their relationships to pulp and dentine.—*Mag.*, 150.

NOTE.—Figures 1, 2, and 4 are photographs of sections prepared by the author's decalcifying process.

PLATE II.

Fig. 3. $\frac{25}{1}$

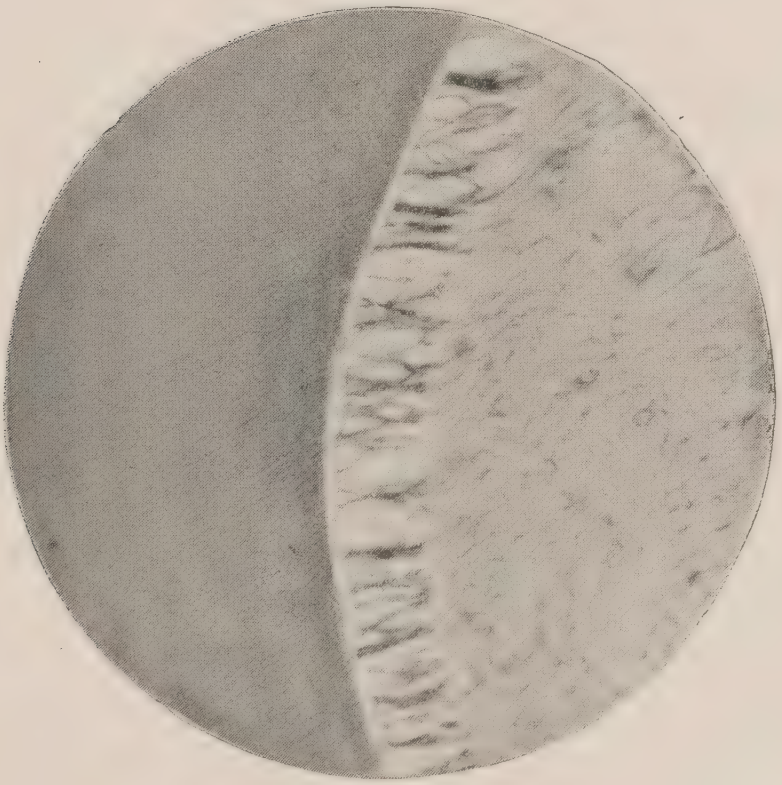

Fig. 4. $\frac{150}{1}$

whereas they would run at right angles to that surface if odontoblasts formed matrix. (See Mr. Mummery's remarks on this matter in *Transactions of the Odontological Society* for February, 1892, and also Mr. F. J. Bennett's notes in same *Transactions* for November, 1888.)

(8) The dissimilarity in the shapes and sizes of the cells is against the acceptance of this view; this dissimilarity would be inexplicable if they formed dentine. Osteoblasts do not differ thus.

(9) The fact that secondary dentine nodules in the pulp are formed by small round cells, and that odontoblasts take no part in this work, is clearly seen when sections of pulps containing calcareous degenerations are cut *in situ*.

(10) It is a law that after a cell has ceased its functions, it atrophies and disappears. Here, however, odontoblasts persist long after all dentine matrix has been completed.

(11) In some sections of the root, with pulp *in situ*, here and there odontoblasts are absent. It is remarkable that in these situations their corresponding tubules are wanting. (plate i., fig. 2).

(12) And finally there must be added Mr. Underwood's [12] statements—"that the distinction

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[12] *Op. cit.* pp. 27, 28.

between fibril and matrix is not merely one of degree of calcification," for which are given three proofs; "that all traces of the boundaries of the cells are absolutely obliterated even in imperfectly developed tissue," and "that the cells and their processes are sharply marked off from the surrounding tissues during all the stages of development."

Positive Evidences.

In order to deal scientifically with the evidences which are at hand, to show what *are* the functions of the odontoblasts, it is important to take three things into consideration, viz., the development of these cells, their relation to the nutrition of dentine, and the question whether or not the ultimate ramifications of the nerves do enter the odontoblasts.

And here arise the most serious difficulties in connection with the subject. The odontoblasts, as far as is known, are derived from the stomodœal mesoblast, *i.e.*, they are formed on the edge of the up-growing papilla of the dentine organ. If it could be proved that they arise from epiblast, one great difficulty would be removed, for it would be then quite easy to affirm that they are nerve endings or end bulbs, and their analogy to the cells at the terminations of the optic and

auditory nerves would be more striking, not only with regard to their morphology, but also their physiology. Most authorities agree that the nervous system is produced primarily by the epiblastic layer of the blastoderm. Schäfer remarks in the last edition of Quain (vol. i, part ii., page 352), "All nerve-fibres and nerve-cells . . . . . are originally derived from the neural or neuro-sensory epiblast." Accepting these statements, one is led to the conclusion that odontoblasts cannot possibly be, from a developmental point of view, ganglion cells in which sensory or tactile or trophic impulses arise *de novo*. But it is no argument against the idea that they serve as sensation transmitters.

Again, it is difficult to believe that odontoblasts serve merely as factors in the production of and keeping up the nutrition and vitality of dentine, for, as has been pointed out, they are practically absent from the radical part of the pulp. If this were their office, there would be no diversity of shape or size. Dentine is vitalised, in my opinion, by a protoplasmic exudation which emanates from the pulp, and fills the tubules by surrounding and protecting and nourishing the fibrils. The pulp capillaries end near the odontoblasts, but do not enter the tubules.

It is an extremely difficult matter to have optical proof that the terminations of the nerves

enter the basal extremities of the odontoblasts. It would be different if the nerves did not lose their medullated sheaths. The staining and demonstrating of these delicate threads would then be quite easy. But we have the presence of the basal layer of Weil, which exists in that part of the pulp which is most sentient. Pain from irritation and destruction of the fibrils begins in the crown and neck of a tooth, and not under cementum; and Weil's layer consists of fine fibres which extend deeply into the pulp on the one hand, and into the basal ends of the odontoblasts on the other. The inference, therefore, theoretically and logically speaking, is that the fibres in Weil's layer are non-medullated nerve fibres. This can only be disproved by the experiment of severing the main trunk of the nerve and cutting off communication with its centre, and examining the pulp for any degenerative changes that might occur. Gowers [13] writes, "If a fibre is cut off from its parent cell it degenerates; the part still in connection with the cell does not degenerate." The actual performance of this experiment is impracticable at present for me unfortunately. If it could be done, it would, I think, settle this intricate question.

As odontoblasts are largest and most important

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[13] "Diagnosis of Disease of Brain," 1885, p. 4.

in the corono-cervical portion of the pulp, as their functions must be closely associated chiefly with this part—in consequence of their large size and importance, and as this part is that only through which nerve sensations can reach the pulp *viâ* the tubules, therefore it would seem that the odontoblasts must be more intimately connected with the nervous system than has hitherto been supposed, and they must be the actual end organs or dental ganglia of the nerves of the pulp. And the corollary is that the term odontoblast is a misnomer.

B.—The Cells of the Pulp Proper.

Their Morphology and Physiology.

Little remains to be said about the central cells of the pulp. They vary in size and shape during the various stages of the growth of the pulp. In developing teeth they are large, and have rounded, angular or spindle-shaped outlines. In short, they partake of the nature of embryonic cells generally. Their nuclei are large, prominent and granular, and contain no nucleoli. Near the superficial portion of the tooth they are very loosely held in the meshes of the fine connective tissue stroma: and here more spindle cells are seen.

In adult teeth the pulp cells are chiefly stellate

or angular in shape. Their number is greater, as a rule, than the ordinary round cells; but cells of any description are comparatively few. Connective tissues and nerve filaments are marked. The branches of these cells are long and numerous, and interlace with one another, giving the pulp the appearance of a mucoid tissue. Few cells exist in the radical region of the pulp. A few insignificant-looking odontoblasts are found, but the mass of the pulp seems composed of bundles of thick and thin connective tissue fibres, running in all directions, and separated at the periphery by large vacuoles.

If transverse sections through cervical and radical parts of the pulp be examined and compared, a great difference in structure will be noticed. In the former, in addition to the cells already mentioned, are great quantities of double-edged highly-refractive fibres, which are not connective tissue as is seen in the latter. They are probably nerve filaments. In fact, it would seem that the greater part of the body of the pulp is composed of nerve filaments.

With regard to the fine connective tissue fibres which are scattered generally throughout the pulp, it is probable that they serve not only as a stroma in which the cells are imbedded, but as a supporting framework to sling up the soft delicate pulp in its bony casing, in much the same

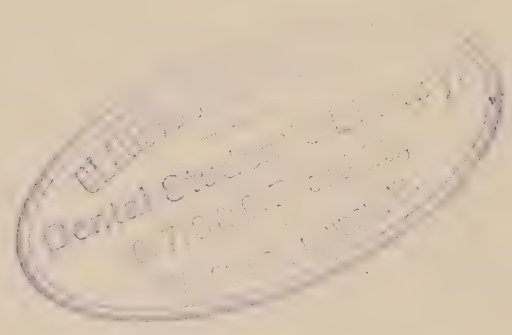
way as marrow is supported in the medullary cavity of bones. These fine fibres appear not to enter tubules, but to be attached to the matrix of dentine.

The functions of the spindle-cells is probably a generative one—to produce new odontoblasts in places where the old cells have been modified by the advancing line of freshly-deposited dentine. The round cells would seem to have a secretive property, in cases where secondary dentine nodules, or calcareous degenerations are taking place, in addition to the all-important function of laying down the matrix of dentine in developing teeth. *These* cells, then, should be called odontoblasts.

In conclusion, these researches and arguments tend thus to show what probably are the functions and uses of the cells of the pulp; but it is at present impossible to say absolutely that this view is right and scientifically correct. But until they are disproved we may, I think, believe that the building of the dentinal wall of the pulp does not depend on the integrity of the odontoblasts, but on the functions of the small secretory cells of the pulp proper; and that while the former are active agents, governing and protecting, as sense organs or end bulbs, its interior, their duties only ending at the death of the pulp, the latter are more passive agents, serving merely for

mechanical purposes by secreting matrix or new bone formations during the life of the tooth.

Gentlemen, allow me to thank you heartily for your kind attention to my communication. The subject is very technical, but I trust that it has been made an interesting one for all present.



Discussion.

Mr. F. J. Bennett said the members would probably all take one view in expressing their approval and admiration of the specimens exhibited, and of the arguments which had been brought forward in their explanation. No doubt, together with Mr. Hopewell Smith, they had all experienced a severe shaking in their views and convictions on the subject of odontoblasts within the last few years. Different methods had arisen, and different explanations had been given in these matters. He, with many others, was very much surprised to hear the very free remark recently made by Mr. Tomes, for it seemed as though they would have to learn their work all over again. That must not be regretted in the least degree; in fact, it would go on as long as there was anything to be discovered at all, and they must all try to bear an open mind for the reception of new ideas. He was not sure whether the author had mentioned the method employed in the preparation of the specimens, but he believed that he was right in considering that they were not done by the Weil process.

Mr. Hopewell Smith said that they were all prepared by his own method.

Mr. Bennett would have been glad to hear a more detailed description of the method by which it was done, because a great deal, if not everything, depended upon the way in which the specimens were prepared. The diagrams, together with the specimens exhibited, showed something more than the natural structures of the pulp. He thought they showed a certain amount of shrinking, so that they represented not the actual condition that existed naturally in the pulp, but also the effect of chemical treatment, producing shrinkage. He therefore disagreed with the statement that there was no alteration in the structure owing to the addition of chemical reagents, and believed that there was evidence of alteration. With regard to the impossibility of bi-functional activity in the same cell, it might be

true that there was not more than one activity in a cell, but there was more than one condition. It was constantly found that cells not only performed their function, but that in the process of age and degeneration their nature was altered. Therefore, when they saw the odontoblast, which had its processes passing into the dentine, they must remember that there might not only be some function for the soft portion of the cell, but besides that an appearance of a calcification which, although not a function, was a second condition. They might, therefore, say with regard to those specimens, that it would be possible to assume that the odontoblast cells had the function of sending processes into the dentine, but that in the presence of degeneration they became subject to calcification, and that calcification of part of the body of the cell resulted in the hard structure of the dentine. This was not an original idea, but it was one idea which might be entertained, and, as they found in osteoblast cells, this was the idea generally received—that it was a calcification acting upon an originally circular cell, or a cell without processes, and that the processes were produced by the actual encroachment of calcification proceeding from without inwards. So he submitted that they might have the analogy of the osteoblast cell still to lay hold of, to consider that the hard structure was formed from the odontoblast cell. Mr. Hopewell Smith had been candid enough to allude to the difficulties that had to be got over in assuming that any nerve structure, or structure of epiblastic origin, could arise from mesoblastic elements. He had been very fair in that, because to his (Mr. Bennett's) thinking, it was a very formidable obstacle. He had also been kind enough to point out that no connection could be seen between the central termination of the odontoblast and any nerve whatsoever, although it might be assumed. He would, therefore, go away with the idea that he had seen processes entering the dentine in a better way than he had ever seen them anywhere else, but that the theories upon which those were based still remained in doubt.

Mr. W. A. Maggs said the author had not referred to Dr. Sudduth's theory, that dentine is a secretion of lime

salts under the superintendence of the odontoblasts. He maintained that the odontoblasts preside over the calcification of dentine, and are not themselves converted into dentine; that the calcified matter is deposited around the dentinal fibrils, and as it is deposited the odontoblast cells recede, hence dentine is tubular, and by the fusion of contiguous tubules, a solid mass is formed, which is commonly termed the "matrix." The author had said that the cells, after serving their purpose, degenerated and disappeared. He would like to know with regard to odontoblasts when that took place, because they all knew that in abrasion and erosion secondary dentine is formed to a large extent, and he was always under the impression that so long as secondary dentine is formed, odontoblasts are present, and that as soon as the odontoblasts disappear, the result is that no true dentine is formed at all, but simply a granular calcified mass without any particular structure. The author spoke of the calcareous deposit in the pulp where there were no odontoblasts, but he wished to know whether tubules were present constituting true dentinal structure, or whether it was simply a deposit of lime salts in the pulp tissue. That was an important point of distinction.

Mr. Mansbridge, referring to the process employed, said that in his experience he found that the cells did have a great tendency to shrink after the acid treatment, therefore it would be important to know whether there was the same tendency to shrivel in the Weil method of preparing specimens.

Mr. Hopewell Smith, in reply to Mr. Bennett, said the particular sections he had shown were all prepared by his own process: and in reply to Mr. Mansbridge he might say that he believed that the appearances to be found in his own specimens would be similar to those obtainable by the Weil process. He was not a good hand at the latter, and had not made many observations upon specimens prepared by that process. He had asked Mr. Mummery for such a specimen, but unfortunately Mr. Mummery was ill, and he had not had the opportunity of comparing the two methods in their results, though he hoped to do so before long. It was

very difficult to say where was the alteration of structure in cells after chemical agents had been applied to them. No doubt *post-mortem* changes occurred almost immediately after a tooth had been extracted, and it was very difficult really to find the true condition of things. He had made experiments with glycerine and weak acids, and had not found any marked alteration in the structure of the cell as far as he had gone at present. It was probable that in general histology the cells under the microscope were not *actually* the same in appearance as living cells, no matter how carefully the sections had been prepared. Of course the diagrams exhibited were diagrammatic, showing rather an exaggerated form. There might possibly be shrinkage, but he found that if they could get the delicate fibril absolutely *in situ* there could not be much shrinkage, because the fibrils were of more delicate a nature than the odontoblasts themselves, and even the capillaries of the pulp retained their normal shape. Referring to Mr. Maggs' remarks, he was afraid he did not know much about Dr. Sudduth's theory of odontoblasts "presiding" over the formation of dentine. He believed that odontoblasts disappeared in old teeth. He had described them in a paper on "Fibroid Degeneration of the Pulp," in the *Journal of the British Dental Association* as odontoblasts, but thought he had been mistaken, because, although they occupied the periphery of the pulp, he could not really make up his mind that they entered the tubules. He therefore now believed that in old teeth the odontoblasts disappeared. The calcareous deposit in the dentine nodules in the sections shown, apparently contained no tubules; they had a laminated structure, but there was no definite dentinal tubule. He should be glad to have his sections examined a little more carefully by members in order to ascertain if there was shrinkage or not. He did not think there was evidence of their shrinkage, inasmuch as the tubules had fibrils entering into them in what he understood at present as being a normal manner.

The chairman tendered the thanks of the Society to the reader of the paper, and to those who had brought forward Casual Communications.

The following nominations have been submitted to the Council :—

For Resident Membership—

Austen, Leslie G., L.D.S.Eng., 9, Wolsley Road, Crouch End, N.

Brown, Leonard, L.D.S.Eng., 7, Spencer Street, Clerkenwell, E.C.

Freeman, John Robert, L.D.S.Eng., 18, Arabin Road, Brockley, S.E.

Hall, Edward Caleb Joseph, L.D.S.Eng., 18, Orchard Street, Portman Square, W.

Hankey, John Trevor, L.D.S.Eng., 128, Green Lanes, Stoke Newington, N.

Harrison, Philip, L.D.S.Eng., 36, Finsbury Pavement, E.C.

Henley, Albert William, L.D.S.Eng., 175, Victoria Street, S.W.

May, Walter John, L.D.S.Eng., Dental Hospital of London, Leicester Square, W.C.

Mellersh, William Francis, L.D.S.Eng., 2, Eastern Road, East Finchley, N.

Morley, Frank, L.D.S.Eng., 42, Albemarle Street, W.

Pillin, Harry Linsell, L.D.S.Eng., 33, George Street, Hanover Square, W.

Sansom, William Bertram, L.D.S.Eng., D.M.D.Harv., 84, Harley Street, W.

Sewill, Joseph Sefton, L.R.C.P.Lond., M.R.C.S.Eng., 40, Wimpole Street, W.

Spicer, Scanes, M.D.Lond., B.Sc., 28, Welbeck Street, W.

For Non-resident Membership—

Bullen, Harold E., L.D.S.Glas., 7, The Parade, Truro.

Coles, Ernest V., L.D.S.Eng., Montague Road, Uxbridge.

Curle, Arthur, L.D.S.Eng., 30, The Parade, Leamington.

Evans, Albert John Gear, L.D.S.Eng., Windermere, Clythe Park, Newport, Mon.

Ham, Hedley H., L.D.S.Eng., Torquay.

Haynes, Frederick, L.D.S.Eng., 11, Hillmarton Road, Rugby.

Hope, Vacey Limington, L.D.S.Eng., Wellingborough.

Hall, Charles Septimus, L.D.S.Glas., 98, Abington Street, Northampton.

Leigh, Percival T., L.D.S.Eng. and Glas., Portland Crescent, Leeds.

Manton, Edward A., L.D.S.Eng., 14, Grand Rue, Boulogne.

Oram, Charles Henry, L.D.S.Eng., 13, Royal Crescent, Cheltenham.

Vice, William Armston, M.B., C.M.Aber., L.D.S.Edin., D.D.S.Phil., 5, Belvoir Street, Leicester.

Woodcock, Richard Ernest, L.D.S.Eng., Pontefract, Yorkshire.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

December 4, 1893.

MR. W. BOWMAN MACLEOD, L.D.S.,

PRESIDENT, IN THE CHAIR.

THE PRESIDENT said he regretted that at the last meeting there was an omission to report to the Society the loss by death of two members. Mr. W. R. Wood, L.D.S., of Brighton, had been a member of the Council in 1879 and 1880. He was elected a member in 1863, so that his connection with the Society had lasted for thirty years. The other name was that of Mr. J. E. Rose, of Liverpool, who was a member of the Council in 1875, and a Vice-president in 1880, 1881 and 1882. It was a curious coincidence that both these gentlemen were elected in the same year, and both died in the same year. It was decided to send letters of condolence to the relatives of both members.

The President said that Obligation Forms, duly signed, had been received from Mr. EDWARD BLAIN, Bridge House, Taunton, and Mr. CHAS. F. SUTCLIFFE, Victoria Terrace, South Shields, and announced their admission as Non-Resident Members.

Messrs. Clayton Woodhouse and George Hern were appointed auditors for the year.

The Curator stated that he had received from Mr. Morton Smale two donations for the museum. The first was a very good specimen of a class of work much in vogue in times gone past, and which was becoming rarer every day, viz., an entire lower plate carved in bone, with natural teeth inserted for the front. The second donation was a number of fossil teeth from an unnamed variety of hippopotamus. At the present time the authorities of the British Museum were engaged in endeavouring to name suitably the variety, and when their decision was arrived at it would be communicated to the Society.

Mr. Trewby, a student of the Dental Hospital, had presented a model showing gemmation of the two lower centrals with the laterals. The model was taken from a boy aged 5 years, and Mr. Percy Smith—under whose care the boy was—had promised to watch the case, to see whether the permanent teeth were similarly affected.

On his own behalf, Mr. Storer Bennett presented the model showing a conical peg-shaped supernumerary tooth growing between two upper temporary central incisors in a boy aged 6 years.

Mr. W. Hern brought forward a case of circumscribed necrosis of the mandible on the left side, involving the mental foramen. It was the case of a youth aged 19, a recruit, who came to the Dental Hospital, and was seen first of all by Mr. Robbins. When he (Mr. Hern) saw the case, the man had the ordinary symptoms of necrosis. There was a swelling on the left side of the jaw, with a considerable amount of pus oozing up, and on taking hold of the necrosed bone with the forceps it came away easily with a sort of snap. Unfortunately, he did not test the parts to see whether there was any anæsthetic condition of the nerve, but immediately after taking out the necrotic piece he found that the patient had anæsthesia over the area supplied by the mental branch of the inferior dental

nerve. The history was that the man had a blow with a stick. Judging from the state of his mouth and the absence of any external mark, it could hardly be said that the necrosis was the result of violence. His teeth were all normal, with the exception of the lower second bicuspid on that side. He gave a history of having had the attempt made to extract that tooth some time previously. The necrosis appeared to have been due to suppurative periostitis around the root of the second bicuspid, and the specimen showed the close contiguity of the root to the mental foramen.

Mr. Robbins said he distinctly remembered this patient. He was called to see him, but found him in a drowsy condition, and unable to give a history of his case. On being taken into the extracting room a bicuspid root was found very deep down. He failed at the first attempt, but at the second the root was extracted. It was necrosed all the way through. A mouth wash was ordered, and the man was told to present himself at the hospital in a week's time. However, he saw no more of him, and the next he heard about the case was from Mr. Hern.

Mr. Henri Weiss described an angle mallet which had been constructed from an original pattern conceived by himself. He pointed out the existing difficulties which had hitherto been experienced from the want of a reliable mallet for attachment to the dental engine, which would condense cohesive gold in any position, other than the straight, with a varying force under easy control. The action consisted in the recovery of a flat spring raised by a revolving heart-shape disc—a movement he regarded as the acme of simplicity. "This is obtained by a *rod* with an articulating end in a suitable metal boxing and sheath for attachment to the hand-piece of the engine, and being fixed to a heart-shape disc revolves so as to allow the apex to appear above the boxing at each revolution. Above this is fixed, by means of a screw, a flat steel spring, at the anterior part of which is extended a strong steel projection bent at a double obtuse angle, the plugger. It will be seen that by the adaptation of these parts whenever the disc revolves, the spring

and extension rise, to fall by a sudden movement upon the disappearance of the apex of the disc, and thus is obtained a distinct blow at each revolution. This part of the apparatus is wholly outside the mouth, enabling the operator to see his work without being obscured. To prevent the action being interfered with, at least with plugger No. 1, an *arm* is carried forward and lies immediately beneath the plugger following its angles, and not only serves the prime purpose, but prevents the freshly laid piece of foil from being moved, as it is held by the arm. We therefore have only to place the piece of foil in the cavity, when it is held by the extension arm, and the plugger delivers a series of blows until it is secured to the previous layer. The strength of the blow is regulated by a slide plate with a finger table, which passes along a slot above the spring, so that the spring being tempered to deliver the blow zero, the slide plate may be pressed forward until the blow becomes so strong as to nearly stop the revolution of the engine.

"Plugger No. 2, *the Over-reach*, is similar to No. 1, with the difference that its point is longer to allow of it reaching into a deeper cavity, and when the cavity may be too small to admit both it and the arm, but with this one in use the arm must not be pressed against the gold, or the plugger will be raised so high as to escape the action of the revolving disc. Plugger No. 3 has a large convex point to condense non-cohesive foil.

"The advantages claimed by this mallet are, first, the action is the same whichever way the engine revolves; secondly, the plug is obscured by two points, equal only in extent to the points of a pair of dressing forceps; thirdly, the strength of the blow is regulated by a simple movement of the index finger; and lastly, the work is never obscured from view. Messrs. Ash & Sons have undertaken to reproduce the mallet."

Another useful contrivance was also shown by Mr. Henri Weiss in the original model of a chip blower for the dental engine constructed by himself. The great delay in the preparation of dry cavities by the accumulation of *débris* led Mr. Weiss to put together this simple means of disposing

of the same, and was briefly described. Beneath the treadle of the engine is fixed a valve india-rubber ball, from which passes a tube, following the standard and arm to the handpiece, the latter part being provided with a two-way stopcock which directs the current of air from the ball beneath the treadle to within half an inch of the cutting bur. The tap of the stopcock enables the current of air to be diverted to the side when not required for the cavity, preventing any accumulation of air when not in use. The engine hand-piece is in no way rendered clumsy by this addition, for although the calibre of the tube is large to prevent a needle-like blast, it lies conveniently along the side. Mr. Weiss explained that he had tried various means to heat the air, but owing to the rapid radiation of the heat along the tube, in spite of a large spirit lamp heating a metal ball and spiral, no perceptible increase of temperature was obtained. Another feature which led Mr. Weiss to discourage the use of heated air was that the patient did not complain of pain from the current of air; in fact, he proved slight obtunding properties in its use. He always commenced the preparation of the cavity without the air current, and turned it on when the *débris* commenced to accumulate. The ease with which the defective tissues could be watched, and the cutting of grooves facilitated, placed this little machine among one of the most useful additions to our already well supplied wants. Where the electric motor was used the ball could be placed on the floor, and from time to time pressed by the foot. He understood Messrs. Ash & Sons would construct replicas in a convenient form for use with their handpieces and engine.

Mr. Ashley Barrett exhibited a contrivance for carrying a loop of wire for measuring the circumference of roots for crowning. He said it was a home-made device, very inexpensive, and answered fairly well. A similar contrivance had been described in some of the American journals, though apparently not quite on the lines of the one exhibited. The wire loop was passed over the tooth and rotated; the loop was then cut and lifted off carefully.

On the Physiology of the Heart in relation to Anæsthetics.

By John W. Pickering, D.Sc.(Lond.)

Although many brilliant investigators have devoted much time and energy to the study of the physiological action of anæsthetics on the heart, there are many questions still undecided, and the controversy as to the part played by the heart in deaths resulting from the inhalation of anæsthetics shows but little sign of abatement.

Since I propose to treat the subject from an experimental standpoint, it is necessary to remark that it is unwise to deduce generalisations from a single series of animals. To illustrate this I will cite the recent experiments of Prof. Halliburton, who, working with a toxic substance termed nucleo-albumin, has found that albino rabbits are far more resistant to the fatal effects of this substance than are darker animals of the same species.

This "individual idiosyncrasy" in response to the action of drugs which may occur in any group of animals, has not improbably led to the discord-

ant conclusions of different observers, who have limited their experiments to single groups of animals, and have disregarded the results recorded by other experimenters and clinicians. The following are some of the possible modes of action of anæsthetics on the heart.

(1) The anæsthetic acts on the cardiac muscle itself, and may directly paralyse its contractile power.

(2) That the paralysis of the heart, when present, is due to the action of the anæsthetic of the intrinsic cardiac nervous mechanism.

(3) That chloroform syncope is due to a reflex cardiac inhibition caused by irritation of the nerve endings of the vagi in the lungs.

(4) That chloroform primarily paralyses the respiratory centre in the medulla oblongata, and that the consequent asphyxial condition of the blood secondarily paralyses the heart.

(5) That cardiac dilatation, when present, is due to pulmonary obstruction, and that chloroform has no specific action on the heart.

This last view, advocated by Lawrie (1), has been rendered improbable by the experiments of McWilliam (2) and others, who have shown that chloroform will produce dilatation of *both sides* of the heart.

It is obvious that many of the difficulties of the problem are due to the presence of the nervous

system of the animal undergoing experimentation. Gaskell and Shore (3) have, by the establishment of a cross circulation between two animals, allowed the blood of an animal inhaling chloroform to circulate through the brain only, and not through the heart of another animal, and have by this means studied the action of chloroform on the heart *viâ* the nervous system.

Conversely, they have allowed the blood of an animal inhaling chloroform to circulate through the heart of a second animal without passing through its brain. They have concluded that chloroform has a powerful action on the heart itself. But even in these experiments the intrinsic cardiac nervous mechanism (viz., the nerve cells and nerve endings of the heart) remains intact, so that we have a possibility of the anæsthetic acting on the heart through chemical stimulations of the cardiac termination of the vagi.

I have attempted to eliminate this difficulty by experimenting on the hearts of embryos previous to the development of a functional nervous mechanism. The chick embryo between the 50th and 80th hour of incubation presents us with an accessible form of heart minus a nervous system.

Although at this period of development the embryonic circulation is very active, there can be no complication due to a change of blood-pressure.

Also the factor of asphyxia is eliminated, except when purposely introduced, by placing the embryo in an atmosphere of carbonic acid.

But it will be asked what evidence is there that the heart at so early a stage of its development is influenced by drugs in like manner to the adult heart? I have made a large number of experiments to test this question, the details of which are published in recent numbers of the *Proceedings of the Royal Society* and the *Journal of Physiology* (4).

From experiments made on a large number of animals, both vertebrate and invertebrate, it has been concluded that digitalin, caffeine, strophanthin, and veratrine act directly on the adult heart muscle. The typical action of each of these drugs is so well shown on the embryonic heart that it is possible to recognise their dilute solutions by their physiological action alone.

There is therefore evidence that in the embryonic heart we possess a convenient means of determing whether a given drug acts directly on the heart or through the agency of a nervous mechanism. We can easily experiment with chloroform, ether, or nitrous oxide, either pure or mixed with air, oxygen, or carbonic dioxide. We can also test the action of drugs on hearts that have been stopped by anæsthetics, and thus get some indication of that great desideratum—a drug

which will antagonise the toxic action of anæsthetics on the heart.

I should here mention that all my experiments have been made on hearts *in situ*, and under conditions such that their rhythms are maintained for many hours unchanged, provided that no stimuli either chemical or physical be applied to them. With chloroform and ether I have obtained widely divergent results.

Thus one half a cc. of a choloform solution containing .00003 cc. of pure chloroform will, if injected under the blastoderm of the embryo, rapidly reduce its cardiac rhythm and produce an exaggerated diastole. After the injection of .0004 cc. the heart stopped in an extremely dilated condition, but the auricle gave a few twitches in response to mechanical stimuli.

Ether, on the other hand, acts as a powerful stimulant to the embryonic heart. Thus a heart whose action had been stopped by exposure to cold was restored to its normal rhythm by the injection of .003 cc. of ether dissolved in 1 cc. of normal saline. It is only after comparatively enormous doses that ether can depress the cardiac rhythm of the chick embryo. These experiments show that chloroform and ether have an essentially different action on the embryonic heart—that chloroform has a depressor and ether an augmentor action—a conclusion at variance with the view

of Claude Bernard (5) reiterated by the Hyderabad Commission.

Nitrous oxide and air in a mixture of 70 per cent. of N_2O and 30 per cent. of O has but little depressant effect on the embryonic heart. Pure nitrous oxide after several minutes' action stops the embryonic heart in diastole. A mixture of 70 per cent. N_2O and 30 per cent. of CO_2 rapidly stops the heart's action after 30 seconds' exposure.

A mixture of 70 per cent. of N_2O and 30 per cent. of O stimulates the heart. The heart's action is unimpaired after several hours' exposure to this mixture.

Hearts that have been stopped by the above-named mixture of N_2O and CO_2 can often be restored by the passage of a current of oxygen over them.

A mixture of carbonic acid and chloroform is far more toxic to the embryonic heart than a mixsure of chloroform and air. I have failed to restore hearts stopped by chloroform with oxygen.

Raising the temperature of the embryo still in an atmosphere of chloroform or nitrous oxide will usually restore the stopped cardiac rhythm. This restoration is more difficult when there is a large percentage of CO_2 present.

I am therefore of opinion that CO_2 increases the toxic power of chloroform and nitrous oxide on the heart.

The conjoint action of the carbonic acid and chloroform during failing respiration which has been emphasised by Dr. Brunton (6) is worthy of consideration. It has also gained additonal interest owing to the recent researches of Oliver and Garrett (7) on the tension of gases in the blood during anæsthesia.

They have found that during chloroform narcosis there is a tendency for the amount of CO_2 to increase, and the amount of O to diminish.

A mixture of Brin's "oxygen," which contains 7 per cent. of nitrogen, when given with chloroform delays the appearance of anæsthesia and may induce temporary apnœa. The increased oxidation of the tissues causes an excess of CO_2 to be present in the blood, which is, however, scarlet owing to the large amount of oxyhæmoglin present.

In cases where large doses of the anæsthetic stopped the respiration, the heart continued beating.

Thus there is apparently with the administration of oxygen and chloroform less danger of cardiac stoppage than with chloroform alone.

With nitrous oxide alone there was found a marked decrease of oxygen, *but no excess of carbonic acid.*

These observers wrote: "So far as N_2O anæsthesia was concerned, the danger probably depended on the great absence of oxygen, for the carbonic acid

was present in small quantities compared with that in other anæsthetics, but was present in a very large quantity relatively to the amount of oxygen associated with it in the blood."

I therefore understand that Oliver and Garrett apprehend a source of danger in nitrous oxide anæsthesia owing to the lack of oxygen in the blood.

Haldane and Lorrain-Smith (8) have, however, made experiments on human beings as to the effects of an excess of CO_2 with or without a deficiency of oxygen on the respiration and pulse.

They, like Hermans and Miescher, have observed that an excess of CO_2 will induce hypernœa more readily than a deficiency of oxygen.

Hypernœa begins when the CO_2 exceeds 4 per cent. of the atmosphere breathed. An atmosphere containing 10 per cent. of CO_2 will produce extreme distress, followed by frontal headache and often by vomiting. If the percentage of CO_2 be raised to 18 per cent., the respirations are rapidly stopped.

Hypernœa does not set in till the percentage of oxygen has fallen to 12 per cent. of the atmosphere breathed, provided that the carbonic acid be removed. It therefore seems that the deficiency of oxygen in nitrous oxide anæsthesia is not a source of danger, and it may be a question worthy of discussion whether the conjoint administration of oxygen in nitrous oxide anæsthesia by an in-

crease of the amount of CO_2 in the blood may depress rather than aid the organism; whether it is not better to ventilate the lungs with air which will tend to remove the CO_2 without stimulating the production of an excess of CO_2.

On the other hand it must not be forgotten that oxygen has a stimulant action on the heart, Klug (9) Fano (10).

We must now pass to the vexed question as to whether nitrous oxide forms a compound with any of the constituents of the blood, or whether its action is owing to the formation of reduced hæmoglobin and consequent deprivation of the tissues of oxygen. The deficiency of oxygen in N_2O anæsthesia seems to point to this at least playing some part in its action.

Dr. Dudley Buxton (11), contrary to the opinion of Dr. MacMunn (12), has urged the probable formation of compound of nitrous oxide with hæmoglobin, or with some globulin of the plasma.

The recent researches of Christian Bohr (13), who has shown that carbonic acid probably forms a compound with the hæmoglobin of the blood, and the researches of Dr. A. E. Wright (14), which point to a *rôle* played by CO_2 in the chemical compounds formed by the blood plasma, lend much probability to Dr. Buxton's views, and emphasise the danger of conclusions drawn from negative spectroscopic results. The question must be,

however, left *sub judice*. The importance of the existence of a compound of carbonic acid and hæmoglobin is obvious in its relation to anæsthesia, for we have to deal with a new compound in the blood and not with merely dissolved carbonic acid or carbonic acid combined in the plasma as sodium hydrogen carbonate.

This substance may account for an excess of CO_2 being more noxious than a deficiency of oxygen.

We have now to consider if it may be possible to pharmacologically antagonise the depressant action of anæsthetics on the heart.

Dr. Ringer (15) found that if a frog's heart had been stopped by chloroform, the application of a 1 per cent. solution of ammonium hydrate directly to the ventricle will restore the heart's beats almost to their original power.

I have tested this antagonism on the embryonic heart, and find that in hearts stopped in extreme dilatation by chloroform, the application of ammonia will partially restore their rhythm.

Dr. Wood (16), of Philadelphia, has attempted to antagonise the action of chloroform on dogs' hearts. He failed to get any restoration of rhythm by the hypodermic injection of either atropine, amyl nitrite, or caffeine, while alcohol only increased the cardiac depression. Ammonia had slightly beneficial effects, and digitalis, by raising the blood pressure, often averted death.

Caffeine and atropine failed to restore the cardiac rhythm of the embryonic heart after a stoppage produced by chloroform.

I have also not obtained marked results with digitalin, but on this point, and on the action of strophanthin on chloroformed hearts, I hope to make further experiments.

Possibly Wood's results with digitalin may be explained by the vaso-constrictor action of that substance.

Strychnine, in doses of ·00002 gram, increases both the force and frequency of the embryonic heart rhythm. Larger doses are, however, very depressant. Strychnine is well known to have a stimulant action on the respiratory centre in the medulla oblongata. Hence it will promote the recovery of a failing respiration, which, if increased, will help to remove the anæsthetic and carbonic acid from the lungs of the person or animal.

There is, therefore a physiological *rationale* for the use of strychnine in chloroform syncope. Some have suggested the use of interrupted electric current to restore the heart stopped by chloroform.

Chloroformed hearts will, if not too strongly poisoned, respond to electrical stimuli. We must, however, not forget the observations of McWilliam, who has shown that under certain conditions, the

effect of a local application of an interrupted current to the heart is the production of an arhythmic fibrillar contraction of the heart-muscle termed "delirium cordis," and not the production of the normal cardiac rhythm.

I have found that the direct application of heat will often restore a chloroformed heart when chemical and electrical stimuli fail. I shall, therefore, venture to ask if you have tried the application of external heat in the form of hot wet rags over the heart in cases of chloroform heart-failure. From the experimental standpoint, and from its great simplicity, it might not be unworthy of trial, at any rate, in conjunction with other means of restoration.

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Discussion.

Mr. Robbins said it might seem strange that he, not being a scientific man, should take the first place in that discussion. It might seem a little mad, but there was a method in the madness. The title of the paper appeared to one or two of their members to be a little outside the ordinary line, and it had been questioned whether it would not have been better to have read it before a society of anæsthetists. He, however, thought differently, and would explain his reason. It did not always follow that when dentists had finished their curriculum in the hospital, and, having gone to the College of Surgeons, had passed its portals and been blessed with that piece of paper with those wonderful autographs upon it, that they were privileged at once to be able to start in practice in Grosvenor Square or Harley Street, and on behalf of suburban and provincial members of the Society he wanted, if possible, to bend the discussion into a practical channel. The average qualified dental surgeon was not so happily placed as gentlemen practising in the fashionable districts, who had the advantage of being in close touch with those eminent men who had made it their special study to administer anæsthetics, and he knew of no better condition for operating than to feel that they had a first-class man on one side of the chair, whilst the dentist was operating on the other. Taking the average practitioner, he was often called upon by the British public, whether rightly or wrongly, to administer nitrous oxide, either helped by the local general practitioner (and they all knew what that meant), or by a qualified assistant, or, perhaps, a partner. Speaking on behalf of the main bulk of those gentlemen, he might say that they knew, as a rule, with ordinary cases and with the great

majority of cases, what to do and what not to do. Speaking from an experience acquired during some fifteen years, he could count on the fingers of one hand the cases that had given him any anxiety in the matter of gas administration. But a case might occur where it was not simply a question of starting respiration again, or of pulling the tongue forward, or of pinching globules of nitrite of amyl; there might be a case where the heart seemed about to stop, and that was the point he was coming to. Dr. Pickering had given some considerable time to his subject, and had thrown out one or two very practical hints. Seeing that there were gentlemen present of great experience in this matter, he was bold enough to ask them, speaking for the suburban and provinvincial men, to lay down some easy rules that might be adopted should their patients be *in extremis*, so that instead of losing their heads and frightening themselves and the patient's friends, they would know exactly what to do. Dr. Pickering had said that he found the application of heat to the region of the heart very useful. With the dentist hot water was always present; it was very easy to get and to apply, and if it did not do any good it could not do much harm. The injection of strychnine he must leave to be discussed by others, but he really had good hope that although this was a very abstruse and scientific paper, they might be able to cull some good out of it in a practical form.

Dr. Dudley Buxton said he had seldom listened to a more able or scientific paper than that brought forward by Mr. Pickering. It was a paper for which no excuse was needed. They had been told that the point of view to which they should address their remarks should be practical, and in order to carry out that suggestion he would confine his observations to the anæsthetics in use amongst dental surgeons, and not deal with the very wide range of subjects which had been touched upon by the speaker. Perhaps one of the most important points of the paper was the introduction of a method of investigation of the physiology of anæsthesia, probably new to many of the members of the Society.

He referred to the employment of the heart in the embryo, by which means one of the factors was eliminated in the great problem of how anæsthetics might kill. It was a matter of considerable interest to find that Dr. Pickering had found from a comparison of recent authorities, and from his own work, that his results corroborated those at which he (Dr. Dudley Buxton) had arrived from a research which he had undertaken some years ago, and which he had had the honour of bringing before the Society, viz., in a series of papers entitled "On the Physiological Action of Nitrous Oxide Gas." It had always been a great help to him, in dealing with patients, to be able to assure them that the action of nitrous oxide was that of a heart stimulant rather than that of a cardiac depressant.

On that point the paper certainly bore very strongly. They were told that the mixtures of nitrous oxide and oxygen were possibly not so anæsthetic as nitrous oxide pure and simple, and they should bear in mind, when experimenting, what they had heard of the effect on the embryonic heart of the prolonged use of nitrous oxide. The consideration of the experiments referred to would explain many of the failures which were met with. Professor Wood, in a somewhat recent pronouncement, came to the conclusion that nitrous oxide acted purely as an asphyxiant; but, like so many other observers, he overlooked the fact that if nitrous oxide was pushed beyond a certain point, they not only had the physiological action of the pure gas, but it was complicated by asphyxial effects, or by a deprivation of oxygen, producing those familiar spasms and convulsions which always occurred when an animal was deprived of its due supply of oxygen. It might be shown that nitrous oxide, pure and simple, did not produce any effect save its own specific effect, and when so used it was devoid of danger. It was probably that fact which had endeared it so much to the heart of the dentist. Passing on to the question of carbonic dioxide associated with nitrous oxide, such a combination must always be most deleterious, and any method which lent itself to the production of an excess of carbonic dioxide had a deficiency of oxygen which must

be most prejudicial. It was not possible in this discussion to go fully into these matters, and therefore he would pass to the consideration of chloroform and ether, though he was bound to confess that many regarded those agents as, perhaps, rather outside the usual routine of the work of that Society. In speaking of chloroform the lecturer had not spoken of the very recent work of Professor Hare and Dr. Thornton. With reference to the work done by Dr. Wood, these observers had come to quite different conclusions than those at which Professor Wood had arrived. They were aware that Professor Wood was inclined to regard chloroform as a heart depressant, and not as an asphyxiant pure and simple; that was to say, he believed in primary cardiac syncope being a common form of death under chloroform, whereas Professor Hare and Dr. Thornton had come to the other conclusion. They believed that chloroform, if injected into the veins, would produce failure of the heart, and if inhaled, would produce failure of respiration. He need hardly remind the Society that that conclusion was diametrically opposed to his (Dr. Buxton's) own work, and the work of many men far more able than himself. From recent work upon the lower animals, his opinion had been more than ever confirmed that the principal action of chloroform—as far as they were concerned—was its action upon the heart and vaso-motor system, which, telling back upon the heart, induced that terrible syncope against which there was, apparently, no safeguard, and with which there was no competent means of dealing. It had been suggested that various methods might be of use in the attempt to restore the chloroform-injured heart. Professor Wood favoured the injection of strychnine, which was unquestionably of great value—probably of greater value in the lower animals than in man—because the time that elapsed between the occurrence of syncope and the attempt at restoration in man was usually too long to allow of any sufficient absorption of the strychnine, and any action which might be thereby induced was not set up before the patient was absolutely dead. One practice which he himself should regard as being, perhaps, more valuable, was

that of forced respiration, by which air was pumped into the lungs, and so the chloroform was got rid of. With regard to the action of heat, it was interesting to find that in embryo hearts heat had such a powerful restorative action.

In tabulating the very large number of cases which formed the *Lancet* "Chloroform Report" he had found that heat had been applied in some cases, hot water being poured from a great height over the præcordium, in some instances with success, but in many cases with failure. Another method which had been adopted, and it was one of which he had practical experience, namely, that of the mechanical manipulation of the heart, when it showed signs of stopping. It had been suggested, and records had been published in some of the journals, that when heart failure appeared the heart should be grasped, as it could be in most persons who were not over stout, and should be mechanically manipulated. In some cases that method, which seemed perhaps rather rough, had been very successful, even after so long a use as three-quarters of an hour. The question of dealing with ether scarcely called for any prolonged remarks. It had been shown by the lecturer that ether was a powerful stimulant, and they knew that it acted in the same way upon the human being, and was, in most cases, absolutely safe. Without going further into the question he would content himself with congratulating Dr. Pickering and the Society on the very able paper which he had brought forward.

Dr. Silk said he felt somewhat in the position of being between the devil and the deep sea. He did not mean to say that Dr. Pickering was the former or that Mr. Robbins was the latter; but the difficulty was this: if he were to try to be scientific he was afraid that Mr. Robbins would object, and if he were to try to be practical perhaps Dr. Pickering might object, and say that his paper ought not to have been discussed from a merely practical point of view. It was, therefore, a very difficult matter to deal with a paper of that kind before a number of gentlemen who were so pre-eminently practical. Looking at the matter from a

broad point of view, it seemed to him that the paper confirmed, in a very able and unique manner, the observations of so many previous workers, such as Gaskell and those mentioned by the author and by Dr. Buxton. One point upon which he was not very clear was with regard to the use of oxygen with nitrous oxide. Dr. Hewitt, a great authority upon that subject, was present, and would no doubt like to know exactly what was the point of view taken by Dr. Pickering with regard to that. He was afraid that, being a little obtuse, he did not quite gather whether it was meant that the use of oxygen was of less importance than getting rid of the nitrous oxide. Certainly, what he had always taught with regard to nitrous oxide had been that it was not so much a question of asphyxia as it was of oxygen starvation. Oxygen starvation was the condition which gave rise to troubles in the way of jactitation, which was really the bane of the dentist. For that reason he believed, on the same principle, that Dr. Hewitt had introduced a very beautiful method of giving oxygen. The objection to that had always been that the process was an extremely delicate one requiring the skill and ability of Dr. Hewitt to do it properly ; so that if it were possible that a similarly good result could follow the administration of small quantities of air, they would, he thought, get a very satisfactory condition of affairs. He had been dabbling a little in this sort of process himself, administering small and known quantities of air, and although he did not get such good results as with nitrous oxide alone, at any rate there was a good deal of prolongation of the anæsthesia; and just in the same way as with oxygen, there was, in a greater proportion of cases than with nitrous oxide, a good deal of tendency to hysteria and disturbances of that description. Another practical point following the observations made by Dr. Buxton, was the question of asphyxia in any way, by which he rather fancied that Dr. Buxton meant anything like the use of what was known as the supplemental bag. The supplemental bag was almost a thing of the past, and rightly so, but he was not at all sure that its abolition had not been rather illogical. If, as he took it to be the case,

in the administration of nitrous oxide the tissue metabolism was quite at a standstill, there should be comparatively little carbonic acid produced, so that logically there could not be any objection to the use of the supplemental bag at the end of the inhalation. If they could depend upon the carbonic acid alone being a deleterious product (which he did not think was the case) then it was right that the supplemental bag should be abolished. He was very pleased to hear that Dr. Pickering, from the high pinnacle of physiological study, should have confirmed the view which so many had held with regard to the use of alcohol: that was, that it was to all intents and purposes bad. They certainly should be very much disposed to accept that dictum. It had this practical bearing, that so many patients came to the dentist and said, could not they have a glass of brandy, or something of the sort? That was very wrong, not from a high moral point of view, but because from the point of view of the administration of nitrous oxide they were very liable to get subsequent depression. Then, as to means of resuscitation, the question of strychnine had been raised on the suggestion, mainly, of Professor Wood, of Philadelphia. Certainly as far as he (Dr. Silk) had tried it, he had been very pleased with the result, and one need not wait always until the condition was such as to be highly dangerous before it was administered. It was an advantage in prolonged cases of anæsthesia which were to last for an hour or two, or in which a large quantity of blood was likely to be lost, that at a very early stage, if not before the administration, there should be an injection of something like 1-50th of a grain, or more, of strychnine hypodermically. In cases in which he had done this, he had been very pleased with the result. Then again, as to the practical point of heat, the heat of the physiological laboratory was very different *quasi* the heart from the heat produced by pouring hot water on to the præcordium. He spoke with all deference, but he had some difficulty in thinking that heat applied to the præcordial region in that way ever reached the heart at all. He should rather be inclined to say that the action of heat under these circumstances was

reflex, due to the stimulation of the nerve extremities rather than to the actual heat bath applied to the heart. These were all the practical points which occurred to him. He might speak on the more strictly scientific question, but he was afraid that would be wasting time quite unnecessarily.

Dr. HEWITT said they owed a considerable debt of gratitude to Dr. Pickering for his extremely able paper. One felt also that there was hardly time to discuss it as it should be discussed from the purely scientific side. He therefore asked to be allowed to make a few practical remarks, more especially in connection with nitrous oxide, as that was of greater interest for those present than any other anæsthetic. Dr. Pickering's observations had been of particular interest to him in connection with what had been said about oxygen and nitrous oxide. He understood that Dr. Pickering used about 30 per cent. of oxygen with nitrous oxide; and though he did not distinctly state it, he threw out the suggestion that the increased formation of carbonic acid gas might be a source of danger. It was quite obvious that with this large percentage of oxygen, carbonic acid would be produced in larger quantities than with the percentage of oxygen that he (Dr. Hewitt) should venture to advise, and which he continued to employ. It was also obvious that with that large percentage of oxygen, respiratory movement would be feebler, a condition of physiological apnœa would be arrived at, and the interchange between the gases and the air would necessarily be far slower than if smaller quantities—say from 5 or 10 to 15 per cent. of oxygen were used. When 5, 10, or 15 per cent. of oxygen was used with nitrous oxide, respiration was performed in very much the normal manner, and so far from there being any chance of accumulation of carbonic acid in the blood or the lungs, ventilation had taken place freely throughout the whole of the administration. One could hardly understand that there could be any sort of danger from such a condition as Dr. Pickering suggested. He believed the time would come when nitrous oxide would be administered

with oxygen on all occasions, and the more that he saw of this method the more he regarded the use of nitrous oxide free from oxygen as a clumsy, old-fashioned and utterly unscientific method. Although Dr. Dudley Buxton did not at present agree with the administration of oxygen with nitrous oxide, for reasons which he (Dr. Hewitt) could hardly understand, he thought the time would come when he too, on scientific principles, must adopt this method of procedure. Also with regard to the safety of their patients, he believed that the use of oxygen with nitrous oxide was strictly indicated. Before he administered oxygen with the nitrous oxide he had occasionally cases in which it was necessary to pull forward the tongue, and in persons with very rigid chests he had on one or two occasions to compress the chest. There was also one case with which, perhaps, members were familiar—where he had to perform tracheotomy after the administration of nitrous oxide. Now that he gave oxygen with nitrous oxide he had never had the slightest occasion to pay more attention to the patient than if he had been administering air. There had never been the slightest necessity to adopt any remedial measures, and he believed that with the percentage of oxygen which he employed with nitrous oxide there was absolutely no risk. He mentioned this because he had carefully studied the cases, and he believed that no one could bring forward an instance to the contrary. A dog had been kept for seventy-two hours breathing a mixture of nitrous oxide with 10 per cent. of oxygen, and although he did not wag his tail as he was in the habit of doing when he came out of the chamber, at the same time he appeared none the worse for his confinement, and his respiration continued. Looking at Mr. Pickering's valuable paper broadly, he wished to point out a practical fact which was of considerable importance, namely, that the best stimulus to the heart's action was to keep up the respiration. The teaching of the Hyderabad Commission was that when an overdose of an anæsthetic was given it was the respiration which was to a great extent primarily embarrassed. If they could stimulate the respiration, and also the circula-

tion by keeping the respiration perfectly free and supplying plenty of oxygen, whether with nitrous oxide, ether, or chloroform, the circulation would be kept perfectly good. In one or two cases in the hospital he had seen patients in a condition of syncope from pain or other causes. In such cases they had given nitrous oxide with oxygen, and the colour was seen to return and the circulation to improve. Only during the last week Dr. George Oliver brought to the Dental Hospital an ingenious instrument for observing the pulse, and it was found that whereas with nitrous oxide alone the calibre of the pulse diminished and the pulse became smaller, when oxygen was given, in every one of those cases the calibre of the pulse remained full and good, and much better in tone than when the nitrous oxide was given without oxygen. He mentioned these facts because they bore indirectly upon the paper. Dr. Silk mentioned the supplemental bag. Very little need be said about that in connection with the paper. There was one point which occurred to him in connection with the use of oxygen. A great many people believed that when oxygen and nitrous oxide were used, a rather imperfect and insufficient form of anæsthesia was obtained. Reading the results obtained by German observers, who had adopted this method for a length of time, he found it stated that a deeper form of anæsthesia was possible when oxygen was used with nitrous oxide. At first he could hardly accept that statement, but he had at last come round to that way of thinking. The fact was that the oxygen acted as a vehicle to introduce a considerable quantity of nitrous oxide through the circulation, and in that way they got a more profound anæsthesia and longer unconsciousness. It was necessary to point this out, because it might be imagined that the use of nitrous oxide induced a rather insufficient and imperfect form of anæsthesia. He regretted that time did not permit of a longer discussion of this valuable paper.

Dr. Pickering, in reply, said the subject had been dealt with from the practical side by gentlemen well able to deal with it, but there were one or two points he would like to

refer to. As to the question raised by Dr. Hewitt, it would be interesting if it could be determined experimentally at what point the percentage of oxygen administered with nitrous oxide would increase the amount of carbonic acid in the blood. By experimenting with Oliver and Garrett's apparatus, it might be found at what point the conjoint administration of oxygen and nitrous oxide would increase the intravascular gas-tension. He believed that oxygen increased the tension in the blood, but it was possible with small quantities, such as Dr. Hewitt had been using, that it might not do so—that the small doses of oxygen might have no stimulant effect on the metabolism. That was, however, a question to be experimentally determined. With regard to the action of strychnine on the heart, he was glad to know from a clinical point of view that the experience of specialists confirmed his results. The question of heat was also worthy of notice. It was quite possible that heat over the præcordium might act reflexly, and they might get a cardiac stimulus in this way; but would it be possible to get the physiological application of heat to the heart? If it could be physiologically introduced into clinical work it might be of some value. He was sorry that no speaker had touched on the question of electrical stimulation, because that was a matter creating a great deal of interest in the physiological world. It seemed, however, to have escaped notice. Possibly some written communications which might come in afterwards would deal with this question. He begged to thank the Society for the kind manner in which they had received his paper.

The PRESIDENT tendered the thanks of the Society to Dr. Pickering, the reader of the paper, and to those who had brought forward Casual Communications.

Odontological Society of Great Britain.

ANNUAL GENERAL MEETING.

January 8, 1894.

MR. W. BOWMAN MACLEOD, L.D.S.,

PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

The PRESIDENT referred in feeling terms to the loss the Society had sustained in the deaths of Mr. Alfred Alabone, of Newport, Isle of Wight, and Mr. Robert Reid, of Edinburgh, who had been a member of the Society for twenty-five years.

The following nominations having been approved by the Council, were proposed to the Society:—LESLIE G. AUSTEN, L.D.S.Eng., 9, Wolsley Road, Crouch End, N. (resident); LEONARD BROWN, L.D.S.Eng., 7, Spencer Street, Clerkenwell, E.C. (resident); JOHN ROBERT FREEMAN, L.D.S.Eng., 18, Arabin Road, Brockley, S.E. (resident); EDWARD CALEB JOSEPH HALL, L.D.S.Eng., 18, Orchard Street, Portman Square, W. (resident); JOHN TREVOR HANKEY, L.D.S.Eng., 128, Green Lanes, Stoke Newington, N. (resident); PHILIP HARRISON, L.D.S.Eng., 36, Finsbury Pavement, E.C. (resident); ALBERT WILLIAM HENLEY,

L.D.S.Eng., 175, Victoria Street, S.W. (resident) ; Walter John May, L.D.S.Eng., Dental Hospital of London, Leicester Square, W.C. (resident); William Francis Mellersh, L.D.S.Eng., 2, Eastern Road, East Finchley, N. (resident); Frank Morley, L.D.S.Eng., 42, Albemarle Street, W. (resident) ; Harry Linsell Pillin, L.D.S.Eng., 33, George Street, Hanover Square, W. (resident) ; William Bertram Sansom, L.D.S.Eng., D.M.D.Harv., 84, Harley Street, W. (resident); Joseph Sefton Sewill, L.R.C.P.Lond., M.R.C.S.Eng., 40, Wimpole Street, W. (resident) ; Harold E. Bullen, L.D.S.Glas., 7, The Parade, Truro (non-resident); Ernest V. Coles, L.D.S.Eng., Montague Road, Uxbridge (non-resident); Arthur Curle, L.D.S.Eng., 30, The Parade, Leamington (non-resident); Albert John Gear Evans, L.D.S.Eng., Windermere, Clythe Park, Newport, Mons. (non-resident); Hedley H. Ham, L.D.S.Eng., Torquay (non-resident); Frederick Haynes, L.D.S.Eng., 11, Hillmarton Road, Rugby (non-resident); Vacey Limington Hope, L.D.S.Eng., Wellingborough (non-resident); Charles Septimus Hall, L.D.S.Glas., 98, Abington Street, Northampton (non-resident); Percival T. Leigh, L.D.S.Eng. and Glas., Portland Crescent, Leeds (non-resident); Edward A. Manton, L.D.S.Eng., 14, Grand Rue, Boulogne (non-resident); Henry Charles Oram, L.D.S.Eng., 13, Royal Crescent, Cheltenham (non-resident); William Armston Vice, M.B., C.M.Aber., L.D.S.Edin., D.D.S.Phil., 5, Belvoir Street, Leicester (non-resident); Richard Ernest Woodcock, L.D.S.Eng., Pontefract, Yorkshire (non-resident).

The Treasurer presented his Report, which was adopted.

The Librarian reported that during the last year several books had been added to the Library by the kind donation of their authors and others, which had been duly acknowledged at the ordinary meetings of the Society. He regretted to report that, on taking stock of the books in the Library, several were not to be found. Some of these had been missing for many years, but others must, he thought, be in the possession of members who had accidentally omitted

to enter their names, or to see them entered, in the book kept for that purpose, and he proposed to publish with the Transactions a list of the books which are missing, with a request that any member having any of them in his possession would notify the fact to the Librarian.

The Council, after carefully considering the question of the use of the Library and the borrowing of books, had decided to appoint a Sub-Librarian, who will be in attendance three evenings every week from 6.45 to 8.45, when members and visitors (on the presentation of the card of a member) would be able to use the Library for reading and reference purposes. They had found it necessary to restrict the privilege of borrowing books to members of the Society, as, with the rapidly-increasing number of dental schools and dental students, it was impossible any longer to extend it to students of the Dental Hospital of London. Dental students would, however, in common with other visitors, be admitted to the Library on presentation of a member's card, and it was hoped that these facilities would greatly increase the use of the Library as a library of reference.

Since the last meeting, the three papers by Signor Vicentini, on which Mr. Mummery's paper of the evening was based, had been presented to the Society by their author.

The Curator presented the following Report:—He said: "As on former occasions at these Annual Meetings, it has not been considered necessary to enumerate the specimens that have been presented during the year, in consequence of their having been described at the meetings at which they were received, I do not propose on this occasion to inflict an enumeration upon you. But I would like to say that this evening we have had presented to us two models: one by Mr. E. Lloyd-Williams, of a probable exostosis of the palate, which has been in existence for a great many years. The patient is aged 45, and he has known the enlarged and hardened condition of this palate for at any rate twenty-five years. The other is a lower model presented by Mr. Andrew Wilson, showing what he describes as 'a conoid enlargement of the right lower temporary molar.' It is a very interest-

Odontological Society's Accounts for the Year November 1st, 1892, to October 31st, 1893.

Dr.	£	s.	d.
To Annual Subscriptions	466	4	8
,, Arrears	45	3	0
,, Entrance Fees	71	8	0
,, Sale of Transactions	7	19	7
,, Return of Premium on taking out New Fire Insurance Policy	2	0	0
	£592	15	3

Cr.		£	s.	d.	£	s.	d.
By Rent					150	0	0
,, Fire Insurance					6	0	6
,, Meetings.	Baker—Lantern Exhibition	2	10	0			
	Bale—Notices, Postage, &c.	16	18	6			
	Hire of Microscopes	1	5	0			
	Reporting	10	10	0			
	Camps—Refreshments	26	7	11			
					57	11	5
,, Library.	Lewis—Books and Periodicals	6	12	6			
	Watkins—Books	5	5	0			
	Year Book of Societies	0	6	0			
	Hersant—Binding	5	0	0			
	Camps—Sub-Librarian	5	5	0			
					22	8	6
,, Museum.	Curator—Money Disbursed	2	12	0			
	Shaw—Work at Museum	15	15	9			
	Hutchins—Carpentering	1	15	0			
	Thonet—Chairs	3	17	0			
					23	19	9
,, Transactions.	Bale & Sons	123	3	9			
	Sub-Editor	9	12	0			
	Woodbury—Past Presidents' Portraits	4	4	0			
	Engravings and Zincographs	4	1	3			
					141	1	0
,, General.	Bale—Notices, Postage, Lists of Council, Stationery, New Bye-laws	38	10	9			
	Treasurer's Postage	2	11	6			
	Secretary's Postage	4	0	0			
	Camps—Gratuity	5	5	0			
	Registrar, Friendly Societies—Fee	1	1	0			
	Ellis—Cost of Transfer of Stock	2	17	3			
	Owen Memorial Fund—Subscription	10	10	0			
	Kent—Albo-Carbon Light	14	0	0			
	Deed and Letter Boxes	0	17	0			
	Bank Commission	0	3	6			
					79	16	
					£480	17	2

	£	s.	d.
Balance at Bank, October 31st, 1892	262	4	11
Gross Receipts, November 1st, 1892, to October 31st, 1893	592	15	3
	£855	0	2

	£	s.	d.
Gross Expenditure, November 1st, 1892, to October 31st, 1893	480	17	2
Consols purchased £218 19s. 11d., costing	214	3	3
Balance at Bank, October 31st, 1893	159	19	9
	£855	0	2

	£	s.	d.
Gross Receipts for the year, November 1st, 1892, to October 31st, 1893	592	15	3
Gross Expenditure	480	17	2
Surplus of Receipts over Expenditure	£111	18	1

INVESTMENT ACCOUNT.

	£	s.	d.	£	s.	d.
Amount in £2 15s.% Consols, October 31st, 1892				3257	17	6
Consols purchased Nov., 1892, cost £138 12s. 2d., producing	142	2	6			
Consols purchased, Jan., 1893, cost £75 11s. 1d., producing	76	17	5			
				218	19	11
Dividends, January, April, July and October 1893, £93 8s. 11d invested, producing				94	3	7
Amount in £2 15s.% Consols, October 31st, 1893				£3571	1	0

EXAMINED AND FOUND CORRECT, DECEMBER 20th, 1893 { A. E. CLAYTON WOODHOUSE. GEORGE HERN.

We have examined the above accounts with the books and vouchers of the Society, and find them to be in accordance therewith. We have verified the amounts of the dividends on the Stock and the balance at the Bankers on the 31st Oct., 1893.

December 15th, 1893.

HENRY BROWN & SON, *Chartered Accountants*,
13, Victoria Street.

ing specimen, and cannot fail to be of value to us in our collection.

"In speaking of the Museum for the year I would say that, in common with the Library, it is proposed in the future that a larger opportunity shall be afforded to members and visitors for availing themselves of the specimens that are in the Museum, since the Council has arranged for the Sub-Librarian to be in attendance on three evenings a week, viz., Monday, Wednesday, and Friday, from 6.30 to 8.30. He will, as far as possible, afford every facility to members examining specimens in the Museum, for finding individual specimens required; and any other help that he can render will be at their service. Visitors will also be admitted to the Museum on presentation of a card from a member; and, as it is not to be supposed that the Sub-Curator can know all members and visitors, each one will be requested to enter his name in a book to be kept for the purpose.

"In addition to the treasures contained in the Museum, the Council has also provided for the Society a microscope, which it is hoped will be found useful, not only at our ordinary evening meetings, but also to any members or visitors who wish either to examine microscopic specimens in the possession of the Society, or for microscopical sections which they may bring down for examination on the particular evening. I am sure the Council generally, and I personally, will be very glad to receive suggestions from any members as to the desirability of introducing any variation in the time of opening the Museum, or with regard to the usefulness, either of the specimens, or of the time of the Sub-Curator."

Mr. C. Robbins showed a combined mirror and drip point, and said for years he had been in the habit of using Stoke's drip point, but there were some places in the mouth that could not be well reached by that apparatus. There was also the objection that in changing the wheel, one had also to change the bend of the drip point, which was rather inconvenient, and in time it became bent and broken. It

had occurred to him that if one could use the drip point secured to the back of the mirror, it would occasionally be useful. He therefore arranged a small contrivance that would fit the back of any glass of a certain diameter, with a small indiarubber connecting tube, and a ball filled with water, to be held in the left hand, for the purpose of throwing light, and at the same time water, to any tooth in either jaw. The difficulty at first was in working on the right side of the mouth; but, after eight months' practice, he found that by always working from the left, whether it was used on the left or right side of the jaw, any part of the mouth could be reached. A second and simpler form of the instrument dispensed with the loose arrangement, which made it a sort of universal thing. As a matter of practice, he found that it was better to stick to one glass, and there was nothing gained by changing it from one to another. The arrangement was simply a little bit of metal tube soldered obliquely to the back of the mirror, and could be carried out in one's own workshop. Notwithstanding the fact that one was rather apt to look on one's own child with favour, he still thought that the apparatus would be found useful to those who might adopt it.

Messrs. Ash and Son had arranged to make some from the second pattern shown.

Mr. J. Howard Mummery was called upon to read some notes on the recent investigations of Dr. Vicentini on the micro-organisms of the mouth. His communication was as follows:—

Some attention has lately been drawn to the investigations of Dr. Filandro Vicentini, of Chieti, Italy, on the cryptogamic flora of the mouth, and I have been requested to present these views in the form of a casual communication.

I am in the somewhat difficult position of having to describe these researches without being able to consult the original in English; no translation having yet been made from the Italian. I have had, therefore, to rely upon the author's summaries and letters, and upon the Italian description of the plates.

Dr. Vicentini's communications are comprised in three

papers, communicated to the Royal Medico-Chirurgical Academy of Naples. The first, published in 1890, "On the Sputa of Whooping Cough;" the second in 1892, entitled, "New Bacteriological Studies on the Sputum, and on the Morphology and Biology of the Micro-organisms of the Mouth;" and a third memoir, published in 1893, on "Leptothrix Racemosa."

The question raised is, I think, one of considerable interest, although I venture to think there are very few among us who will be prepared to follow Dr. Vicentini on the paths of what appears like speculative deduction on which he has entered.

The author claims to have discovered a new form of micro-organism in the mouth, which he calls "leptothrix racemosa." This organism he describes as a very highly specialized one, resembling in its mode of reproduction the algæ—the class of cryptogamic plants immediately above the fungi.

As there is a good deal of misconception as to the real significance of the term leptothrix, I will commence by a short description of what is now understood by the term; I will then proceed to describe the organism which the author calls "leptothrix racemosa;" and finally, will deal shortly with Dr. Vicentini's views as to the significance of this organism, and its relation to the other bacteria of the mouth, as far as I am able to understand these views.

Messrs. Leber and Rottenstein, in their work on "Dental Caries," published in 1867, refer the organisms found in carious teeth to elements of the leptothrix fungus, and speak of them as characterised by the formation of a beautiful violet colour, when treated with iodine and acids. The term leptothrix was really indiscriminately applied to various organisms in the mouth, some of them giving the violet iodine reaction, some not doing so, some showing distinct articulations, others none at all; in fact, as Dr. Miller says in his "Micro-organisms of the Human Mouth": "Almost every living organism occurring in the mouth was designated by this common name. Hallier and many of his successors up to the present time adopted this view. The

motile bacteria of the mouth were regarded as the swarm spores of leptothrix buccalis, the immotile (cocci, &c.) as the spores at rest. Elements of leptothrix buccalis were found everywhere."

The term leptothrix is now usually restricted to the forms of micro-organism which occur in the mouth as long, thin threads, which show no divisions or articulations, and which are not coloured violet by iodine and acids.

Very little is known with any certainty of the biology of the leptothrix forms in the mouth; they resist all attempts at cultivation on artificial media.

If a scraping from the fur which forms upon the teeth is examined under a microscope, a matted collection of organisms is found, chiefly made up of masses of interlacing filaments, enclosing in their meshes numerous micrococci and bacteria. To this thread-form, which is *un*jointed, and does not yield a violet colour with acids and iodine, Dr. Miller has given the name of "leptothrix innominata;" the micrococci entangled in the meshes he does not consider to have any genetic connection with the threads, although they were formerly regarded as its spores. These threads and granules take a yellow colour with iodine and acids, but have no violet reaction.

The long chains of bacilli which do show a violet colour with iodine the same author calls bacillus buccalis maximus, and the chains of micrococci which also show the same colour he names iodococcus magnus. Other straight or curved filaments, much resembling the bacillus buccalis maximus, but showing no violet reaction with the acid iodine, he calls leptothrix buccalis maxima; but whether this is a distinct organism from the bacillus buccalis maximus, or simply younger cells of the same organism, which in this stage do not yield the characteristic violet reaction, the author is unable to determine.

We thus see that leptothrix means very little as a strictly scientific term; it has been used as a convenient name by which to describe many various forms of micro-organisms in the mouth; and even when the subject is reduced to something more like order by the above classification, we

are still in complete ignorance, so far, as to the life history of the leptothrix and the genetic relations of the different forms.

Dr. Vicentini has assigned to these organisms an importance even greater than they were supposed to possess before.

L. Racemosa.—The author proposes to change the name of leptothrix buccalis, in the old nomenclature (including the leptothrix innominata, leptothrix buccalis maxima, and bac. buccalis maximus of Miller) to leptothrix racemosa, in order to indicate its fructification.

This fructification or sporulation is only found in the upper layers of the leptothrix masses, whilst the old filaments of the same organism occupy, according to him, the deeper layers, and constitute what has been formerly described, generally, as leptothrix buccalis.

Dr. Vicentini advises that the outer surface of the white deposit upon the teeth be very gently scraped with a needle, and a minute portion about the size of quarter of a millet seed placed upon a glass slip, with a drop of a weak solution of lactic acid. This should be done in the morning, fasting, before there has been any abrasion of the surface by tooth-brush or food.

The preparation should then be teazed out with needles upon the slide, adding to it a drop of a solution of iodine; the cover glass should then be applied and gently compressed to thin out the preparation, and it should be left to stain for about 15 minutes.

The preparation is then examined under the microscope, and according to the author, it is necessary to use a $\frac{1}{25}$ immersion lens to see the appearances he describes as resembling bunches of grapes.

He speaks of this as consisting (1) of the fertile filament or central stem with reserve gemmules inside; (2) the peduncles or sterigmata, arranged in six longitudinal rows; (3) the sporules; (4) a gelatinous protective envelope.

The author says that the sterigmata or threads by which the sporules are implanted on the outside of the central stem cannot be seen with a lower power than a $\frac{1}{25}$. He

describes other structures as the adult male organs, which can be studied with lower powers, and a younger condition of these male organs (antherids or spermogones) which are very minute. These, he says, are best treated with aniline water and an aniline dye, without washing the preparation. Dr. Vicentini is very anxious that the occurrence of these forms should be corroborated by others, and it is certainly very desirable that a thorough examination should be made by competent observers, for the purpose of corroborating or contradicting these descriptions.

I made two attempts with Dr. Miller in the summer to see these organisms, and we were both times unsuccessful; but on one occasion lately, I certainly detected appearances very similar to those organs which Dr. Vicentini compares to grape bunches, and made drawings of them at the time.

The regular lines of rounded bodies, which the author considers to be spores, were plainly seen, and the central stem, but I was unable to see the minute peduncles, by which he describes the spores as attached to the central stem. The club-shaped appearance of these bodies was also very evident, but so far I have been unable to see anything that I can identify as corresponding to the two forms of the male organs, although I do not consider I have done justice to the author in my search for these, and shall renew the attempt.

The forms which I saw certainly seem to be too regular in shape to be explained as an accidental accumulation of granules or micrococci, around an isolated filament (an explanation which has been given by some observers). Looking upon these appearances as representing the male and female organs of the leptothrix, Dr. Vicentini considers that this organism, in its mode of reproduction, shows analogies, both with the fungi and the algæ.

While, however, we do not question the possibility of the existence of all the forms described by Dr. Vicentini, although at present his observations need decided confirmation by independent skilled observers, yet I think, in passing to the more theoretical part of the author's communications, we shall find it very difficult to follow him, or in the present

state of bacteriological knowledge, to agree with him in his deductions. I cannot but feel, however, that whatever we may think, it is difficult to do full justice to the author's arguments without having the English translation before us. Dr. Vicentini considers that the forms of micro-organisms, hitherto known in the mouth, consist either of the inferior phases of this one micro-organism, the leptothrix racemosa, in either the filiform state, the dissociated state, or the zoogleic state; or, secondly, to the sporules detached from the female filaments (the grape bunches); or, lastly, to the male elements, the antherozoids detached from the adult male organs, and freely swimming in the fluids of the mouth.

To the first group (the inferior phases of the leptothrix racemosa) the author refers the filamentous forms usually called leptothrix, the bacilli and the bacteria, as well as vibrio spirillum and spirochæte; to the second group (the detached sporules of the female filaments) he ascribes the micrococci found in the mouth; and to the third group (the detached male elements) he ascribes the comma-shaped bacilli and some other forms.

The author finds this same organism, the L. racemosa, in the sputum of whooping cough and other diseases, and goes so far as to consider several of the pathogenic bacteria, as the tubercle bacillus, the pneumococcus and the gonococcus, as derivations of the same micro-organism, and he traces various transition forms which he illustrates in his paper.

These statements are so very revolutionary, and the position seems to be such a very untenable one, that one feels almost inclined, without having further proof, to pass over the theoretical part without further discussion, but some eminent bacteriologists have from time to time promulgated somewhat similar views, such authorities as Nägeli and Buchner having held that the species of bacteria are not fixed, but are affected by variations in external conditions. Zopf founded a classification of the lower fungi on the basis of this view of the instability of the species,

and there is the famous saying of Nägeli, quoted by Frankel[1] and others, which is as follows :—" If my view is correct, the same species in the course of generations take different morphological and physiological forms, which in the course of years bring about, sometimes the sourness of milk, or the acid fermentation of sour kraut, or the fermentation of wine, or the putrefaction of albuminous substances or the reddening of food containing starch; sometimes producing typhus fever, cholera, or intermittent fever."

As Prof. Frankel says, if the above were correct, scientific investigation of bacteria would be an impossibility.

This view of the inconstancy of the species of bacteria has been rapidly losing ground, as the methods of securing pure cultivations have been more perfected, and much doubt has been thrown by Flügge and others upon the reliability of the earlier experiments undertaken without the strict precautions now found necessary in making pure cultures.

It is well known that many micro-organisms are pleomorphic, that is, they appear under different forms. Dr. Miller has described several of these organisms in the mouth, and in a recent letter he says he has lately repeatedly found in pulps, one kind which in pure culture shows two very distinct forms in the same colony, but in such a case the same organism always shows its own definite two or more forms as the case may be. These seem to be the definite morphological states of the particular organism.

Many micro-organisms when subject to abnormal conditions, such as insufficient or improper nutriment, exhibit the so-called involution forms, which are often very unlike the species in which they occur, but if the abnormal conditions are removed, the typical form is soon re-established; no permanent change has taken place.

Dr. Vicentini's views differ, however, from those of Nägeli and Buchner, in that he derives the different organisms of the mouth from the different phases and portions of one parent organism, and there are grounds on which some such opinion might perhaps be founded. For instance, in

[1] Frankel's " Bacteriology," American edition, p. 2.

the last edition of the Encyclopædia Britannica, article "Fungi," the following statement occurs:—"In many fungi, no sexual reproduction is known to exist, but it is generally believed that in such cases the plants are merely members of a cycle of generations, the other stages in their life history being unknown or unrecognised."

Whilst in the higher fungi there is a true sexual reproduction—both male and female organs being present—no such process has been traced in the fission fungi, with which medical research is chiefly engaged. They multiply by division, and, under certain conditions, by the formation of spores.

In reply to the remark that his deductions do not harmonize with the results obtained by extended experience in cultivating mouth bacteria, Dr. Vicentini says his "arguments go to prove that culture experiments are not conclusive in deciding these cases of genetic connection; the inferior phases as in cultures being common to entire families, the fructification being the fundamental differential character of the cryptogamic species."

As Prof. Miller points out, how under Dr. Vicentini's view can we account for the many different pathogenic actions of the bacteria of the mouth? For instance, "a pure culture of the micrococcus of sputum septicæmia, one to two days old, will invariably kill a mouse or rabbit; a pure culture of some other bacterium from the same mouth, under exactly the same conditions, may have no action at all." This seems very extraordinary if they are all derived from one single form in the mouth.

It is quite possible that, as the study and knowledge of these lower fungi advances, and the whole life histories of particular organisms are more carefully worked out, it may be found that some of these organisms are only phases in the life history of a more complex one, as suggested by Dr. Vicentini; but it seems to the majority of observers very improbable that so many distinct forms, differing not only in appearance but in vital action, should arise from one parent form only. There seems, in fact, so little on which to base this assumption, that one might, with almost equal justice,

derive all the bacteria found in the body from this same organism; and I think the author would scarcely admit this.

I have endeavoured to explain Dr. Vicentini's views as well as I can with the small amount of material I had at my disposal in an available form; and while I do not wish to be held, in any sense, responsible for these views, I think they are of sufficient interest to engage the attention of a society like our own.

Mr. Storer Bennett said he had had the opportunity of seeing a patient whom he had brought down that evening, and who presented such very unusual characteristics as to make his case one of very great interest for members of that Society. He was a man aged 23, a "leader up" of stained glass, in which work he had been engaged for seven years; but as far as could be ascertained, his occupation had nothing to do with his present condition. He had never suffered from any of the ordinary symptoms of lead-poisoning, either colic, drop-wrist, paralysis, palsy, or anything of the kind. Therefore, any view might be laid aside as to his present condition having resulted from his occupation. On examining the mouth, the mucous membrane of the gum in the upper and lower jaw was found to be extremely swollen, very soft, and deep red in colour, but, at the same time, not very vascular. On touching the surface with an excavator, even if it was inadvertently pushed through some of the soft mucous membrane, no bleeding whatever, or only a very slight lip bleeding, followed. The man stated that all his life, up to within four months ago, he had suffered from a slight tendency to hæmorrhage, more particularly from the gums, but at that period it ceased, and very shortly afterwards the swelling of the gum commenced. Looking at the case for the first time, one was apt to think that it was an ordinary hypertrophy of the gum, but as soon as the swelling was felt it was noticed to be perfectly different from such a condition. It was not hard, but, on the contrary, very soft, and readily pulled away

from the teeth. It almost entirely enclosed the back teeth, and some of the front ones were very deeply embedded in it, but the gum could be pulled away right to their necks. A very small amount of tartar was noticed on the necks of the teeth, but that did not seem to be accountable for the overgrowth of the gum. Taking a blunt instrument, one was quite unable to pass it up by the roots of the teeth. There was no discharge, no escape of blood, when the part was touched, and, although the teeth were more or less loose, there was no pain whatever, and the man was perfectly free from any difficulty in eating. The gum of the palate on the left side was exceedingly enlarged, forming a perfect ridge, so that one's finger could be hooked round it. Curiously enough, the same condition appeared on the inner side of the lower jaw on the opposite side of the mouth. When he came into the Middlesex Hospital, under Dr. Cayley, three weeks since, it was on account of a roseolar rash, which very soon yielded to treatment. The case was shown to Mr. Hulke and to Mr. Bland Sutton, who said they had not seen such a case in the human subject. Both agreed, however, that horses were subject to it, and that veterinary surgeons were familiar with it under the name of "lampas." In America, the treatment adopted was to give the horses free purgatives and then put them at once on green food, the gums quickly resuming their normal condition. The condition occurred in the spring of the year, when the horses had been kept on dry food for several months. In such cases they were noticed to refuse their food, and the gum was found exceedingly swollen.

On the motion of Mr. F. J. Bennett, seconded by Mr. Mummery, the proposed alteration in the by-laws with regard to the date of the Annual Meeting was carried. By this resolution the date of the Annual Meeting was changed from January to June, and it was agreed, on the motion of the President, that the officers elected that evening should hold office until the next Annual Meeting, which would take place in June, 1895.

The PRESIDENT declared the following list of officers duly elected :—

PRESIDENT.

Frederick Canton.

VICE-PRESIDENTS.

Resident : R. H. Woodhouse, Ashley Gibbings, A. W. Barrett.

Non-Resident : F. H. Balkwill (Plymouth), W. E. Harding (Shrewsbury), George Henry (Hastings).

TREASURER.

S. J. Hutchinson.

LIBRARIAN.

W. A. Maggs.

CURATOR.

Storer Bennett.

EDITOR OF THE TRANSACTIONS.

Edward Lloyd-Williams.

HONORARY SECRETARIES.

C. Robbins (*Council*), J. F. Colyer (*Society*), C. Woodhouse (*Foreign Correspondence*).

COUNCILLORS.

Resident : J. Ackery, A. Underwood, H. Rose, C. D. Davis, C. E. Truman, W. R. Humby, W. B. Paterson, H. Baldwin, J. Gartley.

Non-Resident : H. C. Quinby (Liverpool), D. W. Amoore (St. Leonard's), Wilson Hogue (Bournemouth), G. G. Campion (Manchester), J. McKno Ackland (Exeter), J. H. McCall (Leicester), T. Arkövy (Budapest), A. W. W. Baker (Dublin), F. E. Huxley (Birmingham).

The PRESIDENT then delivered his Valedictory Address.

THE PRESIDENT'S VALEDICTORY ADDRESS.

It is usual for the President at the close of the session to give a short valedictory address, which on this occasion, owing to more vital business having brought us to a late hour of the night, must be a very short one indeed. The valedictory has, I find, been usually confined to a brief *résumé* of the work done during the past twelve months, and I think I cannot do better than follow in the footsteps of my predecessors.

I am happy to say that 1893 has been a year on which we may look back with some degree of satisfaction. While the outside worlds of commerce and politics have been surrounded by gloom and marked by disappointed hopes, the bright expectations with which we entered upon the past session have been amply fulfilled.

The record of our transactions shows that we have been full of life and activity; that not only have our members been ready to place before us, and through us before the profession at large, their wisdom and experience in the form of casual communications, as to many minor, yet helpful inventions, improvements, cases and incidents in practice, but they have also contributed largely in original and carefully-constructed papers, the results of painstaking and long-continued observation and scientific research.

At the February meeting we made a promising beginning with a lucid and instructive paper on "The Medical Aspect of Remote Pain in Dental Diseases."

At the March meeting the Secretary, in the absence of the author, read a paper by G. W. Watson on "The Pathological Condition of the Dental Pulp."

The following meeting was devoted to casual communications, when some very practical and useful ideas were

brought under the notice of the Society by Messrs. R. H. Woodhouse, Redman, Coffin, Mansbridge and Humby.

The month of May meeting was principally taken up with an exhibition by Mr. Howard Mummery of Dr. Carl Röse's models, prepared from microscopic sections, of developing teeth in the human fœtus, and an explanation of his views with regard to the origin of the permanent teeth, from the original tooth-germ band rather than from the neck of the enamel organ of the temporary tooth.

The June sederunt was almost wholly and profitably taken up by an exhaustive discussion on "Empyema of the Antrum." The subject was introduced by Mr. Ackland, and taken part in by many of the members.

In November we had a capital paper by Mr. Hopewell Smith on "The Cellular Elements of the Dental Pulp," profusely illustrated with noteworthy photo-micrographs.

In December we had a most interesting paper by Dr. Pickering, giving the results of a long-continued and elaborate series of experiments on "The Physiological Action of Chloroform on the Fœtal Heart," and we have now brought our session to a satisfactory termination with a paper by Mr. Mummery, in which he has given us a clear exposition and temperate criticism of the views recently promulgated by Dr. Vicentini, of Italy, who claims to have traced the origin of mouth bacteria to a common organism having true reproductive organs and an elaborate method of fructification.

This announcement must be received with caution. The existence of this organism has yet to be verified, and the subject is at present engaging the attention of Mr. Mummery, in London, and Prof. Miller, in Berlin.

Several important changes have been made in the bye-laws of the Association, and these will, I have no doubt, tend to minimise labour in conducting the business of the Society, as well as extend its usefulness.

The one which has been sanctioned to-night I need not make any special allusion to, further than to express the hope that it will induce an ever-increasing proportion of our non-resident members to come to the annual meeting and take an active interest in the administration of its affairs. I would further call your special attention to another alteration which ought to tend to the commonweal. I refer to the great facility which is now afforded to dental students and visitors from all over the kingdom for observation and study in the rich and extensive Library and Museum of the Odontological Society, placed at their disposal for reference on three evenings of the week.

This is a movement in the right direction, and is imbued with the catholic spirit which should control the actions of all scientific and professional societies.

In the month of July, I, along with Mr. Campbell, of Dundee, and Mr. Brownlie, of Glasgow, attended the annual congress of the Institute of Public Health at Edinburgh as your delegates, but as the congress officials have not yet reached an enlightened appreciation of the importance of Odontology, I am sorry to say that our presence tended more to the replenishment of that body's treasury than to the elucidation of matters connected with Dental Hygiene.

With regard to the numerical strength of the Society during the past year, I regret to say that we have lost five members by death, six by resignation, and one by removal from the list.

Our roll of new members for the year is, however, an encouraging one; twenty-five have entered, and one ordinary member, Mr. Imrie, has been transferred to the honorary list, and in addition you have heard this evening that there are twenty-six names in nomination for ballot at the March meeting.

It now only lies with me, gentlemen, as your President, to bid you good-bye, and in doing so permit me to thank

you for your sympathy and your forbearance with me in my shortcomings and my absences, for which latter I can only plead distance as my excuse.

I have striven to do my best by you without sacrificing the interests of my clients at home, and perhaps you will allow that I have not been altogether neglectful of the honour and interests which you placed in my charge last January, when I remind you that out of eight meetings I have attended five, and to accomplish this I have travelled four thousand miles.

Permit me furthur to acknowledge the deep obligation I lie under to the Council and to the Vice-President who discharged my duties during my absence, and to the two Secretaries, who week by week and month by month kept me posted in all the work of the Council and the general business affecting the welfare of the Society, I would tender my personal as well as my presidential thanks.

You have elected as my successor a gentleman who has not only the ability and the time, but who has that without which these two were worthless, the desire and *perfervidum ingenium* to carry him bravely through the protracted session which the alteration in the date of our annual meeting imposes upon your newly-elected office bearers. To him I would say from my heart's core, Fare you well, while I tender to you my official Good-bye.

Mr. David Hepburn, in proposing a vote of thanks to the President for his address and his services to the Society, paid special tribute to Mr. Macleod's tact and wisdom, and reminded the members of his prominent position in the North, where his unbounded energy was ever to the fore in every great reform.

Mr. Mummery seconded the vote of thanks, which was carried with acclamation.

The President, in reply, said his services were not due to

any special ability, but rather to a desire to benefit his fellow-men, and especially the Society over which it had given him singular pleasure to preside.

A vote of thanks to the officers of the Society was proposed by Mr. WOODRUFF, and suitably acknowledged by Mr. MAGGS.

The PRESIDENT tendered the thanks of the meeting to those who had brought forward casual communications.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

February 5, 1894.

MR. FREDERICK CANTON, M.R.C.S., L.R.C.P., L.S.A., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the last meeting were read and confirmed.

The CURATOR, on behalf of Mr. Norman, a student of the Dental Hospital of London, presented to the Museum an interesting specimen of dilaceration of the right upper central incisor. The tooth, he said, presumably was injured at the time the child was 2 years of age. On one occasion, climbing up on to a table, he slipped and struck his face with considerable force, cutting the upper lip with his temporary tooth; so much so as to necessitate the interposition of a surgeon to sew it up. As time went on, and he cut his permanent teeth, it was seen that the right upper central incisor was considerably damaged, and at the age of 16 it got so loose that it came under Mr. Norman's observation at Poplar Hospital, and was extracted. On examination it would be seen what an immense amount of bending and laceration must have taken place, and how large an amount of new tissue had been thrown out to unite the injured portions. At the same

time it was very remarkable that so slight an amount of damage had been done to the succeeding portion of enamel that had been developed. He intended to make a section to see the condition of the pulp cavity, and, if possible, to get a section right through the middle for microscopical examination.

Mr. Storer Bennett said some ten years ago he had three patients under his treatment in the Dental Hospital—two brothers and a sister, aged respectively 12, 11 and 10. They were suffering from superior protrusion, and were under treatment for some time, deriving considerable benefit, but then passed away from his ken, as was unfortunately the way with so many hospital patients. Last year a child, 12 years of age, was brought to him who turned out to be a younger sister of this same family. At the time the original cases were under treatment he took models of the mouths and presented them to the Museum. He was so interested in the fourth child coming up that he got the mother to induce the children, who had then grown up, to let him see the present condition of their mouths and to take models. He also obtained photographs of the children from the age of 6 upwards, and they were interesting as showing that even as early as that, certain peculiarities could be traced about the face that might be of value in suggesting permanent treatment before protrusion of the front upper teeth took place, and so preventing the abnormality occurring to so large an extent as unfortunately happened in the case of these children. The family history was also interesting, because the condition of superior protrusion affected the maternal grandfather, and then seemed to have skipped a generation, neither the father nor mother of the children having the slightest tendency to it. In the case of the boys the treatment was effectual in reducing the abnormality to a considerable extent, but unfortunately in the case of the girl, she gave up the use of the retention plate prematurely, and the mischief had returned to a worse extent than in the other two. He thought that if it could be recognised at an early age of a child, from the appearance of the lip and the hereditary condition of the family,

that superior protrusion was almost inevitable in the mouth, it would be not only justifiable, but advisable to remove the first temporary molars, and, thrusting the forceps well up into the socket, to remove the developing first bicuspid, in order to prevent a malformation which was very difficult to cure.

Mr. F. J. Bennett exhibited two sets of models, the first being from a lady aged about 30, and who had worn an upper plate for seven years previous to the time of taking the models. Superior protrusion had occurred, and an impression taken with the plate in the mouth gave the exact measure of that protrusion from $\frac{1}{6}$ to $\frac{1}{8}$ inch, during the seven years since the plate was first made. A great additional interest arose from the fact that the bite was underhung, and it showed therefore that three at least of the commonly ascribed causes of superior protrusion were absent, namely, the pressure of the incisors against the upper teeth or the gum behind them, and secondly, the absence of any pressure by the lower lip on the back of the upper teeth; and thirdly, the shape of the plate and its band prevented any driving forward of the front teeth by pressure from the back ones.

The second case illustrated superior protrusion due to the loss of the back teeth, in a patient of 83. The points of interest were the complete adaptation which had taken place at this advanced age. The patient was hale, and the teeth quite firm, but the upper ones had been gradually driven forward, and the lower front ones fitted into depressions which they had made in the gums behind the upper teeth. The cutting edges of the incisors were worn by erosion, not by attrition.

Mr. William Hern related an interesting case of multiple "dentigerous cysts," occurring in a patient, a boy aged 9. He said the case was interesting, both from its rarity as well as from other collateral points. The little boy was first seen in February, 1893, by his colleague Mr. Matheson, and he regretted that he was not present that

evening to give his own account of the case. Mr. Matheson transferred the patient to Mr. Hern for surgical treatment in the Middlesex Hospital.

Present state, Feb., 1893.—The right side of the face shows marked bulging in the malar region; there is also some swelling of the left side of the face, but not so marked. On examining the mouth, there is a fluctuating painless swelling occupying the right alveolar region above the teeth. The swelling extends from the right central incisor to the region of the first molar, and is as large as an elongated pigeon's egg. On the outer surface of the left alveolar ridge another painless fluctuating swelling can be detected about the size of an almond; this swelling is situated about half an inch above the teeth on the outer alveolar surface. On passing the finger backwards from this swelling, two or three hard bony prominences can be felt, suggesting to the touch the cusps of unerupted teeth.

The teeth present in the upper jaw are:—right and left permanent central incisors; right and left temporary lateral incisors; right and left temporary canines; first and second right upper bicuspids; first right and left permanent molars.

On examining the lower jaw a small elastic, fluctuating swelling, as large as a flattened Barcelona nut, is also found occupying the front surface of the alveolus on the left side, between the left permanent lateral incisor and the left first temporary molar in the region of the unerupted canine tooth.

It was decided that it was a case in which surgical interference was desirable for the cysts in the upper jaw, and the lad was taken to Mr. Pearce Gould, who was present this evening, and who would kindly tell them the nature of the operation he suggested and carried out.

The cysts were opened by Mr. Pearce Gould. On the floor of the right upper cyst a lateral incisor tooth was found lying almost horizontally, with its crown directed forwards and outwards; it was decided to leave this tooth and give it a chance to erupt. The right temporary lateral incisor was extracted.

On opening the left upper cyst a lateral incisor tooth was

seen deeply placed, with its crown projecting through the roof of the cavity in an almost vertical direction, but with a slight backward inclination ; this also was left.

Mr. Hern took models of the mouth and the teeth *in situ*. The small cyst in the lower jaw on the left side was not touched.

February 3, 1894.—The patient was seen, and the incisor tooth, which had been left in the floor of the cyst on the right side, was erupted to the extent of one-third of its crown, but its direction was so horizontal that Mr. Hern thought it advisable to remove it.

The tooth was placed in its position on the model taken last year, and a plaster cast procured. (This was shown).

Mr. Hern mentioned the following points of interest in the case :—

(1) The cysts were multiple. As far as he was aware no previous case of multiple dentigerous cyst in the human subject had been recorded; indeed the statement made in text books was that they were always single.

(2) The bilateral symmetry of the cysts in the upper jaw ; the cysts occurring on each side in connection with the permanent lateral incisor tooth. It is interesting to note that Mr. Sutton has noticed this bilateral symmetry to occur in the lower animals affected by the same pathological condition—notably in goats.

(3) The mischief caused to the jaw and teeth by these tumours seems to be in proportion to their depth from the surface and contiguity to a pre-existing cavity, like the antrum, to which they could spread. The cyst occurring in the lower jaw having come to the surface and burst, was self-cured, without any disturbance to the left permanent canine, with which it was connected, that tooth having, as shown in the model, now assumed its normal position in the arch ; whereas the pressure of the expanding cyst on the developing left bicuspids had led to such deviation in their direction that the crowns pointed inwards and their buccal surfaces were opposed to the bite of the lower teeth.

(4) The models of this case, taken in February, 1893-94, show an interesting fact in regard to eruption, viz., that a

tooth which has been disturbed in the jaw having been bared to five-sixths of its length and one-half of its circumference, retains, nevertheless, a tendency to erupt. The right permanent lateral incisor, which is seen in the first model embedded in the floor of the cyst, is seen in the second (taken twelve months after) to have moved forward nearly half an inch, and to be erupted to the extent of half its crown.

Mr. Pearce Gould explained the nature of the operation. The mucous membrane was cut, and then the cyst wall opened. The cyst was not enucleated in a body, but in several pieces. The same method was followed with the next larger cyst. When the first cyst was opened, the permanent lateral incisor was at once observed lying horizontally and deep in the cyst, as shown in the model. The points of the case, which interested him as a surgeon—and he spoke with all humility before a society of dentists—was the fact that the wound entirely healed up without removing the tooth. He had always been taught that the proper treatment of dentigerous cysts was to open the cysts and remove the teeth. His own feeling was, in every case where possible, to remove the cyst wall, and this he did in this instance; and he might say that in spite of his leaving the tooth there, the whole cavity had healed up. The same thing happened on the left side; but there was this difference, that on the right side the tooth had erupted, while on the left it had not yet done so. Then the smallest cyst of all, which he left alone, entirely disappeared when the tooth had erupted. The question occurred to him, how far nature might be left to do its own beneficent work in some of these cases.

Mr. F. J. Bennett said he was extremely interested in the progress of this case. He had been a little sceptical as to any conservative result from the treatment, but he thought Mr. Gould was deserving of great praise for carrying through this operation. It was the very essence of conservative dentistry to be able to destroy the cyst wall and to bring down the tooth, regulating it so as to make a

complete cure. With regard to Mr. Sutton's classification of odontomes, no doubt he took a very broad scientific view of tooth tumours, and proposed not only to include hard tumours, either in dentine, enamel, or cementum, but also the soft tissues, which went to form either follicle or any part belonging to the tooth structure. This applied more especially to the multiple contents of the cysts in which the tooth, in a soft condition, was broken up by the pressure of fluid and became a series of denticles. If this was to be considered as an odontome, they should include also all retained teeth, because it was only a question as to whether the fluid which naturally existed between the enamel organ and the capsule accumulated in large amount and formed an obvious cyst, or whether it dried up and they simply got the hard portion of the tooth retained and called it a retained tooth. If this was to be called an odontome, they must apply the same term to a retained tooth, for there was no hard-and-fast distinction between a retained tooth and a dentigerous cyst containing a perfect tooth, in which there was a large amount of fluid. There was a certain amount of fluid in any retained tooth, although it dried up.

Mr. J. F. Colyer mentioned the case of a patient who came to the hospital some months ago with extensive destruction of the upper and lower front teeth. The man was engaged in testing sugar boiling for confectionery purposes. This was done by means of the teeth, and as a result of his occupation, very marked destruction had ensued. The incisors were level with the gum; the canines were standing, but were extensively destroyed at the gum margin. In the lower jaw there was also extensive destruction from the second bicuspid on the one side to the second bicuspid on the other. The man stated that the teeth first commenced to decay at the gum margin, gradually corroded away, and broke off. The majority of the teeth seemed to be wearing away. In many of them the decay was quite hard, having reached the condition sometimes called "arrested decay." He had since had the opportunity of seeing a patient engaged in a similar business. There was extensive decay in every tooth, and there

also it appeared to commence at the gum margin. The case was worth the inspection of those interested in such matters.

Mr. Baldwin then opened a discussion on "Root-filling."

Discussion on Root-filling.

The question which arises at the outset, in the consideration of the advisability of immediate-root-filling, is as to the nature of the objection which is raised against it.

The objection commonly urged against it, is that pericementitis in some form is more likely to ensue, or become uncontrollable, after immediate-root-filling, than after root-filling which has been preceded by previous treatment.

In order, then, to pave the way it seems necessary to state the nature of this pericemental inflammation, and the manner in which its causes come into operation. Everything seems to show that the pericementum primarily becomes inflamed by absorption of some of the products of putrefaction, and some of the micro-organisms which cause putrefaction, both of which previously lodged within the pulp canal; and that it may be kept up by the micro-organisms thus absorbed living and proliferating within the pericementum, and thus supplying fresh quantities of toxic material. For this absorption primarily to take place, it seems to be necessary that these putrid products and organisms should come into actual contact with the pericementum at the apical foramen. Virulently putrid material may be lodged in the pulp-canal without any irritation of the pericementum, provided that it remains entirely within the canal, but if any force intervenes which displaces some of this material out of the end of the root into contact with the pericementum, inoculation may be effected, and inflammation set up. There is nothing to support the idea that the pericementum can ordinarily be infected through the substance of the dentine and cementum; in fact, the channels which unite the dentinal tubules with the canaliculi of the cementum are so exceedingly minute that the tooth substance may here be

regarded as a solid wall, effectually barring the progress of irritant matter, excepting in those rare cases where pathologically large channels run transversely between the pulp-canal and pericementum.

It might be objected here that if this theory were all sound, it would be always safe to fill a tooth with putrid pulp-canals at once, without removing the putrid contents, provided no force were used which could displace any of the putrid material into contact with the pericementum. This treatment we know is unsuccessful in practice. The inflammation which follows is probably to be explained, not so much by pressure of malodorous gas upon the pericementum—though the gas would inevitably collect under pressure—but by some of the putrid material being forced into contact with the pericementum by the pressure of this gas. This seems especially likely when we consider that the gas would be generated throughout the mass of the putrid material, and chiefly at the end of the root furthest from the apex, where the putrescent material would be in greater quantity, and the gas from which would be in a better position to project a quantity of the poison against the membrane.

Now, as to the claims of immediate-root-filling.

Its advantages. (1) It is obviously a great advantage to both patient and operator to be able to immediately permanently fill a root with the certainty of success, in the case of patients who cannot give another sitting.

(2) It is obviously a saving of time, as there is but one fixing of rubber-dam, and there is no time lost in placing and removing unnecessary dressings.

(3) It is an advantage to plug the apical foramen as soon as safe to do so, as the pericementum is thereby safeguarded from sundry forms of irritation, not the least of which are sundry pricks inflicted upon it by nerve bristles, and, again, the alterations of tension, which the insertion and removal of wet wisps of cotton wool inevitably produce when they fit the channel more or less tightly, as they generally do, and so act as a piston.

(4) In addition are the collateral advantages of inspiring

a perfection of manipulation and a thoroughness of procedure, which are of great value. It is only by very delicate and thorough treatment, with regard to the removal of putrid material, the avoidance of displacing any through the apical foramen, and the gaining of thorough and direct access as far as possible to all parts of the canal, that success is at all likely to be attained.

Its disadvantages. Provided there is perfect safety in it, there are no disadvantages in immediate-root-filling.

The advantages, however, are considerably lessened by the facts that its perfect safety is in all cases doubtful, unfortunately, and that there is usually an insufficiency of time during a first sitting to carry through all the processes of opening up, cleansing, and filling the cavity of the pulp-canal and the cavity of decay, and again by the facts that a trial dressing takes up but a very little extra time, provided the patient has to come again, and that if followed by serious inflammation, the consequences of immediate-root-filling are very sad.

It may be noted here that if, as usually happens on a first visit, there is an insufficiency of time to carry through all the processes incidental to the treatment of a dead and putrid tooth, it is advantageous that all the preparation should be done on the first day, and all the filling on the next, if no inflammation of a threatening character has intervened, as by this means the tooth is tested, and very often one thorough drying and application of the rubber-dam suffices, viz., that which has to be done for the fillings.

Now an enumeration of the *dangers* of immediate-root-filling.

(1) When introducing a nerve-extractor or nerve-canal drill into a root which contains putrid fluid, it is exceedingly likely that the tension so produced will displace some of the putrid fluid into contact with the pericementum, or even quite through the apical foramen. The immediately subsequent attempt at disinfection may fail to neutralise the activity of this poison, and a painful inflammation may be set up, which, if the canal is irremovably filled, cannot be directly treated nor pressure relieved; while the converse

is the case if the root-filling admit of easy removal. The danger in this direction would probably be greater in the case of those teeth which were affected by incipient pericementitis at the outset of the treatment, as here the membrane would be of lowered resistance and more prone to become acutely inflamed.

(2) When roots are causing abscess without "fistulous" opening there may be a considerable potential cavity in the jaw, eroded by the ulcerative process of the abscess. In many cases it will be impossible to thoroughly sterilise and evacuate this cavity by one operation, and then immediate-root-filling will result in an aggravation of the symptoms, if, indeed, any symptoms previously existed.

Again, supposing that an abscess cavity *can* be sterilised, but that it remains full of pus when the root is filled, then the best that can happen is that the pus may become inspissated, and represented by a cheesy mass. Mr. Lawson, in a clinical lecture, was once very emphatic in declaring that in his opinion not one drop of pus in this world had ever been absorbed, but all cases of seeming absorption of pus were really cases of inspissation. It may be argued that there is no objection to a cheesy mass, but this is not so, as inflammatory changes are more likely to ensue in after-time in the neighbourhood of such a dead deposit than at a spot more normally conditioned.

In the opposite method of treatment, viz., the treatment by dressings, the pulp-canal is left open to drain, and antiseptics are introduced at intervals into the canal, and, if possible, pumped through into the potential cavity. Thus the potential cavity becomes more or less rapidly obliterated by the general shrinking together of the inflamed and expanded tissues, if the case be acute, or by the formation of granulation tissue if the case be chronic. In all other parts of the body this is the accredited and most generally successful method of treating abscesses, viz., to combine drainage with disinfection, and so insure the cavity healing up from its base. Thus it is seen that where there is practically an alveolar abscess-cavity in the bone, immediate root-filling runs counter to all the ordinary acceptations of surgical theory and practice.

Now as to general rules. In every case the canals should be opened up thoroughly and vertically, preferably with German screw-cut burs for the crown, and conical burs for the canals, until instruments can be readly introduced into all the canals without bending.

A good filling for pulp-canals should be solid, unirritating, antiseptic, and removable, and should fill up the whole length of the canal. For reasonably safe roots I prefer as a root-filling a stiff solution in chloroform of gutta-percha and hydronaphthol, plus a sufficiency of cotton-wool fibre to carry it into place, and gutta-percha points where the canals are large. This is easy, penetrating, antiseptic, non-irritating, permanent, solid, and can always be removed with a blunt-pointed nerve-canal drill.

For canals which are not considered very safe ones, or which cannot be followed far owing to curvature of the roots, I recommend a root-filling of a mixture of hydronaphthol, eucalyptus oil, and French chalk on a wisp of cotton-wool. This mixture sets into a crystalline mass, but at the temperature of the body is not too stiff to prevent its being drawn clear away from the canal at will. It is highly antiseptic, and quite unirritating. In a bottle it becomes hard, and has to be melted by heat before it can be used, but when melted remains fluid for a convenient length of time.

Classification of Roots for Root-Filling.

(1) *Aseptic Roots.*—Those which have never contained putrid material (as where the nerves have recently been killed with arsenic, or have recently died from acute inflammation).

(2) *Septic Roots without complications (gumboil or abscess; gumboil signifying "sinus").*

(3) *Septic Roots without gumboil but with abscess.*

(4) *Septic Roots with gumboil.*

(1) *Aseptic Roots.*—These should be filled as soon as the nerves are thoroughly out, bleeding ceased, and the canals clean, provided there is no arsenic-irritation. If there be, the canal should be left freely open to the saliva until all tenderness has passed away.

(2) *Septic Roots without complications.*—First remove any solid particles of decomposing nerve, or other solid matter from the canal by means of a fine new barbed nerve extractor, introducing it little by little, and meanwhile frequently withdrawing it, and cleaning away from it any engaged particles. This is to prevent, as far as possible, any pumping caused by driving up any piece of solid matter. Then thoroughly dry out with numerous wisps of dry cotton on fine bristles all the fluid contents of the canal. This is emphatically important, and should be thoroughly done before any fluid antiseptic is introduced into the canal, as removing the most efficient cause of inflammation. Next, pass a fluid antiseptic, as far as possible, along the canal on a fine wisp of cotton. The antiseptic recommended is mercuric perchloride in alcohol (1 in 1,000), or pure carbolic acid. Next, except in the case of unusually large canals, carefully drill out the whole length as far as possible with sterilised probe-pointed Gates' drills, only advancing along the terminal part of the root with a very fine drill, and always avoiding excessively big drills. When using these drills always keep the engine running fast, and press them only gently ; never let the engine stop while the drill is in the canal. Now must be decided the question of whether the canals shall be immediately filled. In most cases it would, no doubt, be safe to do so, but in the absence of strong reasons to the contrary, I should put a loose dressing of eucalyptus-oil into the canals, and a temporary cotton and sandarac stopping into the cavity of the crown, reserving the filling of both roots and cavity till another and generally more convenient day, and instructing the patient to take out the temporary stopping if tenderness should occur. On the next occasion, if no serious inflammation be present, and the temporary stopping be still *in situ*, fill the roots and finish the tooth. If the patient were obliged to remove the temporary stopping through tenderness occurring, dress antiseptically again, and renew the temporary stopping, and so continue until the temporary stopping can be retained without discomfort.

(3) *Septic Roots without gumboil but with abscess.*—

If an abscess be pointing on the gum, open it with a lancet and so convert the case into one with gumboil. When the abscess cannot be opened externally, treatment is often restricted on the first day with advantage to merely making a drill-hole or opening into the pulp-canal, and so evacuating pus and relieving tension. When the tenderness is not excessive, open up the canals, thoroughly free them completely from *débris*, disinfect them well, and if pus is freely forming, leave them open to drain, instructing the patient to merely place cotton dipped in, say, camphorated spirit, loose into the cavity during meals, and to take it quite out during the intervals, and to frequently suck the tooth so as to aspirate the pulp-canal.

If the pus is not forming freely, absorb it all as far as possible with dry wisps of cotton or bristles, then well pump an antiseptic (as creasote) along the canal and proceed in the tentative way described above. Do not fill the root till a temporary stopping has been retained tightly in place for, preferably, as long as a week. Do not use gutta percha as a temporary stopping where the patient cannot remove it.

(4) *Septic Roots with gumboil.*—A gumboil being a sinus leading from a putrid pulp canal provides escape for inflammatory exudation, and therefore would prevent any immediate trouble on immediately filling the root, but in order to ensure the healing up of any suppurating cavity which may exist in the jaw, it is better to proceed as follows:—Well open up the cavity of the pulp chamber, rake out the contents of the canals; insert into each canal a loose wisp of cotton dipped in creasote, or convey creasote into the cavity, if it be in a lower tooth, by means of conveying forceps. If the blades of the forceps be held together and dipped in fluid, they will hold a good quantity of it like a geometric pen, and will drop it when the blades are allowed to separate. Having filled the canals and pulp-cavity with the antiseptic, place a round ball of soft unvulcanised rubber in the cavity, then squeeze the rubber in with the largest ended instrument which can be used until the creasote forces out the contents of the sinus and finally

issues itself freely through the gumboil. Repeat this process at intervals of several days until the creasote will no longer pass through, penetrating the gumboil with a probe to break open any superficial healing over: then permanently fill the roots.

In very long-standing cases where there is a large abscess cavity in the jaw, as proved by probing through the gumboil with a silver probe, the roots may as well be filled immediately. Enlarge the orifice of the gumboil with nitric acid, syringe out the cavity through the hole in the gum with an antiseptic and put in a drainage tube, either of small soft rubber tubing or of gutta-percha tissue rolled into the form of a tube. Cut plenty of holes in the sides of the tube. Repeat the syringing at intervals of several days, removing the tube each time and shortening it as the cavity fills up. If it finally refuses to close and the end or ends of the root or roots remain isolated and bare, amputate them with a screw-cut fissure-bur.

While the foregoing remarks will be seen to discourage absolute immediate-root-filling, they will be seen to encourage the adoption of all the care and thoroughness of treatment which has been so strenuously advocated by the advanced immediate-root-fillers, and it behoves one to acknowledge fully that their labours and arguments have been of immense service to dental art and science, and though not blindly to be followed in the treatment of every individual case, they have been the means of considerably increasing the general success of root-filling, and shortening the treatment of dead teeth all round. First and foremost among those to whom we are beholden for introducing this new departure into this country, and urging its claims, is George Cunningham, M.A. He has here scored a conspicuous success, viewing the matter broadly.

Before the advent of the immediate root-fillers, dead teeth were approached more or less with fear and trembling, and their treatment was protracted over many weary and unremunerative visits, the very idea of immediate root-filling being looked upon as an absurdity. Now dead teeth have lost most of their terrors and treachery, are approached

with a confident feeling, and the number of visits devoted to their treatment may generally be reduced to two.

It is now clear that the main things desirable are to thoroughly and bodily remove all the putrid material from the root without causing inoculation of the pericementum, to disinfect the canal with some potent antiseptic, and to fill it with something permanent and solid; and I think it can be added that in the interest of the patient it is better to wait till the root has had a trial-filling before proceeding to the final stage of the operation.

The discussion was adjourned to the April meeting.

Mr. George Brunton exhibited specimens of a substance named carborundum, from which wheels for engines and powders for grinding and polishing teeth had been produced. It was not a natural substance, and its chemical formula was SiC. Its hardness was between that of the ruby and diamond. It was produced by mixing sand and charcoal dust, putting them into a furnace into which carbon points protruded, connected with a dynamo. The electric current was kept up until the mass crystallised. The silicon crystallised and took up a little of the carbon. After cooling, it was subjected to acid washings to remove the soluble portions, and the mass was crushed. Microscopic sections of the crystals were exhibited.

Mr. Brunton, in reply to a question, said there was no toughness about the material. The specimens of wheels were baked porcelain with the added carborundum, and were therefore brittle. They would not bend.

PRESIDENT'S INAUGURAL ADDRESS.

Gentlemen,—My first duty on taking this chair is to acknowledge the honour you have conferred on me by electing me your President for the ensuing year, and at the same time to assure you that I will use my best endeavours to promote the welfare of this old and honourable Society.

When present, a short time ago, at the Annual Dinner of the Harveian Society, I was struck with a few remarks which fell from the President of that Society. He stated that in 1880 there were 14 Medical Societies in London, and that in 1893 there were no less than 28. This statement he followed up by an earnest wish that some kind of Royal Academy of Medicine might be established, which would incorporate in some form, into one body, these 28 Societies, for, as he truly remarked, at the present time there was no "one body," so to speak, that the public could turn to for an authoritative answer to any question concerning the public welfare.

Another speaker later on the same evening stated that he was not a member of the Harveian Society, because there were only six evenings in a working week available for attending meetings, and these were already more than filled up.

Now, gentlemen, we have a good deal, I think, to be thankful for in this respect, for in London (not counting student Societies), we have only two Dental Societies, viz.,

this, the Odontological Society of Great Britain, and the Metropolitan Branch of the British Dental Association; the former now confines itself exclusively to science, the latter taking science and dental politics also; another Society was started some time ago, but came, I think, very soon to an end.

Our earnest endeavours should be to make this Society as popular as possible, by making our evenings interesting and instructive to the generality of members, and so give no excuse for another Society to be started in opposition to this. Our specialty being a branch of general surgery, is another reason why we should only have one Society in London.

A Society like this not only does good by disseminating knowledge gained by experience from one to another, but does a great deal of good in a social way in bringing members of our profession together to know each other well, and by so doing to strengthen the profession as a body. It also reminds us that we are in a manner the guardians of the true professional spirit, which we desire to see more and more permeating our ranks.

The pressure of trade influences is powerful, and their operations are but little understood by the public, until something occurs which brings suffering to the body or the purse, or to both, while the apparent, and it may be temporary, success of trade methods has a strong fascination for young men in haste to get into full practice.

The Bye-laws of this Society strictly suppress all such unprofessional methods of procedure, and its membership is a guarantee that its individual units seek in every way to act in a truly professional manner to their colleagues, and to the public at large.

Our frequent meetings tend to confirm and support the members in their honourable resolves, and to help those

who are commencing practice to tide over what must of necessity appear to them the hopeless part of their career, and save them from slipping into a lower sphere, from which familiarity and habit may deprive them of any desire to extricate themselves.

I am not sure that it would not be a good plan to follow the course pursued by many other societies, and establish an Annual Dinner; by doing so we should be able to ask a few distinguished persons each year to become our guests, and enable us also to bring our Society more into notice, and in this way very likely help to increase the number of our members, and in the course of my year of office I propose bringing this question before the Council for its consideration.

At the Annual Meeting held last month it was decided for various reasons to alter the date of our Annual Meetings from January to June, and in order to carry out this arrangement, I am, I believe, to hold office rather longer than usual; such being the case, it will necessitate, with the help of the secretaries, my furnishing matter for more than the usual evenings allotted to a President; and as I am one of those rather against asking our medical friends to come and entertain us by reading papers before us, I trust that members of the Society will lend me a willing hand in my endeavours to supply useful and interesting evenings, by not waiting to be asked, but by coming forward and offering anything they may have of an interesting nature to bring before us, either in the form of a paper or casual communication.

I am very much of opinion myself that most instructive evenings can be passed by discussions on ordinary subjects occurring to us for treatment in our daily practice, and I propose to adopt this course whenever we are short of a

paper, instead of going outside our ranks for help; at the same time I would not have it thought for one moment that I do not appreciate the kindness of our medical friends in coming forward with papers, but I think that unless such papers are of special interest, and have a direct bearing on our specialty, this Society should be able to provide plenty of interesting matters from among its own members.

I shall be very glad if individual members of the Society will communicate with me and suggest any subjects for discussion that they think would be of special interest, and with the help of the secretaries I would then endeavour to organise a good discussion on whatever subject might be selected.

At the present time there are, I believe, 367 members of the Society, consisting of 157 London, 175 country, and 35 honorary and corresponding members. Considering the number of good practitioners there are in London and in the provinces, this is not quite a satisfactory number, and I think the Council might well consider in what way we could bring the Society and its advantages more under the notice of practitioners, with a view of getting them to join. I am glad to see that there is a good list of new members to start our year with. Another question concerning this Society which I should like just to mention, is the question whether we should not create the office of President-elect. I myself have not been a Member of the Council now for some two or three years, or perhaps more, and I have felt it a little awkward suddenly to be called to take the post of President without in the least knowing what subjects of interest have been lately before the Council, and I intend asking the Council, among other things, to consider this matter, as it would avoid the little difficulty which I, and no doubt others, have felt.

One reason that I have heard mentioned why London

practitioners do not join the Society is that the subscription is £2 2s., but I cannot believe that this can really be a strong reason, for it must be remembered that the majority of our members are not called upon to join our medical societies as well, and if we recollect the transactions which are published, and which are not issued by many medical societies, I do not think the subscription can be considered too high; added to which we must always bear in mind the fact that we may have to separate some day from our connection with the Dental Hospital, and may have to build or buy a home for ourselves, and this has always been considered by our careful and prudent predecessors, and made them almost from the first put by for a rainy day; there are also other reasons one could urge for still putting by.

I myself should much like to see the Society in more commodious rooms; at the same time, for very many reasons, I should be sorry that we should separate our connection with the Dental Hospital, and if the authorities can, before very long, see their way to building a new hospital, as I sincerely hope they may, I have no doubt they will do much to try and keep us still with them and endeavour to provide us with good accommodation; therefore for the present, if the hospital authorities can see their way to keep us, I think, taking all things into consideration, it is to our interest to stay. The principal things to keep in view in whatever changes take place, are that we shall have a commodious and comfortable meeting room, also a fitting home for our museum and library, and that we shall be able to make such arrangements as shall make them, under certain conditions, accessible to the whole profession at all reasonable times, and if possible, a reading and, may I suggest, a smoking room and a physiological laboratory for the use of members.

I need hardly say that none of these things belong to us now, but we may all hope that in the pending changes which now cast their shadows before, such improvements may be accomplished. Some few years ago, Dr. Walker, when President of this Society, threw out suggestions of a similar nature; may he yet live to see them accomplished.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

March 5, 1894.

MR. FREDERICK CANTON, M.R.C.S., L.R.C.P., L.S.A., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

The following were nominated before the Society:—RHYS PRICE, L.D.S.I., 252, Clapham Road, S.W. (resident); JOHN DENCE WHITTLE, L.D.S.Eng., 17, Summer Row, Birmingham (non-resident); WALTER R. WOOD, L.D.S.Eng., 21, Old Steine, Brighton (non-resident); W. AUBREY FAREBROTHER, L.D.S.Eng., 3, New Street, Salisbury (non-resident).

The following were balloted for and elected members of the Society:—LESLIE G. AUSTEN, L.D.S.Eng., 9, Wolsley Road, Crouch End, N. (resident); LEONARD BROWN, L.D.S.Eng., 7, Spencer Street, Clerkenwell, E.C. (resident); JOHN ROBERT FREEMAN, L.D.S.Eng., 18, Arabin Road, Brockley, S.E. (resident); EDWARD CALEB JOSEPH HALL, L.D.S.Eng., 18, Orchard Street, Portman Square, W. (resident); JOHN TREVOR HANKEY, L.D.S.Eng., 128, Green Lanes, Stoke Newington, N. (resident); PHILIP HARRISON,

L.D.S.Eng., 36, Finsbury Pavement, E.C. (resident); Albert William Henley, L.D.S.Eng., 175, Victoria Street, S.W. (resident); Walter John May, L.D.S.Eng., Dental Hospital of London, Leicester Square, W.C. (resident); William Francis Mellersh, L.D.S.Eng., 2, Eastern Road, East Finchley, N. (resident); Frank Morley, L.D.S.Eng., 42, Albermarle Street, W. (resident); Harry Linsell Pillin, L.D.S.Eng., 33, George Street, Hanover Square, W. (resident); William Bertram Sansom, L.D.S.Eng., D.M.D.Harv., 84, Harley Street, W. (resident); Joseph Sefton Sewill, L.R.C.P.Lond., M.R.C.S.Eng., 40, Wimpole Street, W. (resident); Harold E. Bullen, L.D.S.Glas., 7, The Parade, Truro (non-resident); Ernest V. Coles, L.D.S.Eng., Montague Road, Uxbridge (non-resident); Arthur Curle, L.D.S.Eng., 30, The Parade, Leamington, (non-resident); Albert John Gear Evans, L.D.S.Eng., Windermere, Clythe Park, Newport, Mons. (non-resident); Hedley H. Ham, L.D.S.Eng., Torquay (non-resident); Frederick Haynes, L.D.S.Eng., 11, Hillmarton Road, Rugby (non-resident); Vacey Limington Hope, L.D.S.Eng., Wellingborough (non-resident); Charles Septimus Hall, L.D.S.Glas., 98, Abington Street, Northampton (non-resident); Percival T. Leigh, L.D.S.Eng. and Glas., Portland Crescent, Leeds (non-resident); Edward A. Manton, L.D.S.Eng., 14, Grand Rue, Boulogne (non-resident); Charles Henry Oram, L.D.S.Eng., 13, Royal Crescent, Cheltenham (non-resident); William Armston Vice, M.B., C.M.Aber., L.D.S.Edin., D.D.S.Phil., 5, Belvoir Street, Leicester (non-resident); Richard Ernest Woodcock, L.D.S.Eng., Pontefract, Yorkshire (non-resident).

Casual Communications.

Mr. Humby read a note on copper amalgam, as follows:—

In selecting Sullivan's cement, otherwise copper amalgam, as the subject for a casual communication to this Society, there was some risk of wounding the susceptibilities of those who still employ it as a filling. But the selection of filling materials is a matter of such extreme importance in secur-

ing sound enduring stoppings, that the risk must be taken. If a tooth be fixed in a vice, and a cavity prepared and filled in the most careful manner, under the most favourable circumstances, and be after examined critically with a strong lens, faults, though not serious ones, will be seen. These minute faults may be present and yet not endanger the safety of a plug under ordinary conditions of the mouth. To prove the truth of this, most fillings, which are doing good service, and will probably go on doing so, abound in defects which do not need any lens to demonstrate. Should the substance selected undergo a change of shape because its rate of wear by attrition is greater than that of the tooth substance; should it break up and disappear at cervical margins even quicker than by the wear of eating; should it possess a very objectionable colour and make the tooth tissues a dirty bottle green, then the question must come, is such a combination of faults compatible with the successful conservation of teeth? There are other objectionable features possessed by it, but they must be passed over, as they can only be demonstrated by cases in practice. The faults spoken of can be shown here and put beyond the question of a doubt. The reputation enjoyed by the cement is based on the fact that it does not expand or contract, and an erroneous belief that the salts of copper soaking into the tooth prevented any further decay. Its colour being black, it resembles several other filling materials which did preserve the teeth. Coin silver amalgam is in outward appearance very similar to Sullivan's. Palladium amalgam is also black on the surface, but may be distinguished from copper amalgam by being non-lustrous if scraped or filed. Jamieson's eclipse, if unwashed, becomes a jet black in some mouths. Submarine alloy is black. On the good work done by other materials, the repute has been falsely obtained. Though it would be wrong to say that Sullivan's cement is in every case bound to fail, I can affirm this, that during a practice extending over many years, in no single case were symptoms of failure absent in fillings which came under notice the third year after insertion. Many failures were discovered in time to do some-

thing still, and the teeth were saved after much trouble. Others, unfortunately, by their failure had tired out the patients, and, rather than submit to further trouble, they preferred extraction. In one striking case a young lady who, three days previously had her four front teeth filled on their lingual surfaces with copper amalgam, two of the teeth on the left side became changed in colour to a pale green. The fillings were drilled out at once and gold inserted, but the colour deepened until it was so very objectionable that the crown of the left central had to be replaced by a Logan; the lateral it is contemplated to crown in a like manner. It is not necessary that any comment be made on the alterations in bulk, as the teeth shown will speak for themselves. There is a useful purpose to which the cement may be put, that is, to face the models taken for use in the construction of dentures and crowns to prevent wear during manipulation in the workroom. It may be easily and rapidly made, and the models may be softened and used again and again.

Mr. E. W. Roughton brought forward a case of dentigerous cyst of the lower jaw:—

A. B., aged 10 years, was admitted to the Royal Free Hospital under my care on Dec. 22, 1893. Nine months previously he noticed slight soreness of the lower jaw, followed soon afterwards by the slow development of a swelling in the region of the angle of the jaw. When admitted to the hospital there was a hard, non-elastic swelling the size of half a walnut situated at the left angle of the lower jaw. On putting a finger inside the mouth, the tumour seemed to grow from the interior of the jaw, expanding the outer plate considerably, and the inner plate to a much smaller extent. It was thought that the tumour was probably a myeloid sarcoma, and therefore, the only satisfactory way to deal with it was to operate from the outside.

On Dec. 27, the patient having been put under chloroform, I made an incision one and a-half inches long over the tumour, dividing the facial artery between two ligatures. When the tumour was exposed, it was seen that the bony

walls were very thin indeed, and that the tumour was cystic. On freely opening the cavity, some thin reddish fluid escaped, and the crown of a molar tooth was seen snugly reposing within. The tooth and the lining membrane were removed together; a good sized piece of the cyst wall was then cut away with bone forceps, and an attempt was made to diminish the size of the cavity by breaking in the walls of the cyst, but in doing this the jaw broke across at the angle. The cavity was then stuffed with gauze. Healing took place quickly, and the jaw united well, the patient being sent home on January 17. The encysted tooth—probably the twelve-year-old molar—presents a well developed crown, but is entirely destitute of roots.

Mr. Bland Sutton said the case brought forward by Mr. Roughton was very interesting, as illustrating in a remarkable way some of the very great difficulties occurring to surgeons in diagnosing between a sarcoma and a dentigerous cyst. He thought it a great pity that so progressive a surgeon as Mr. Roughton should still use what was to him a very objectionable term, viz., "dentigerous cyst." Of course, he was well aware that he was addressing the Odontological Society, and from the title of the paper he should not assume that it was anything else than a tumour connected with the jaw. If it had come from any other Society one would have been at a loss to know whether it was an ovarian tumour containing teeth, a pharyngeal or rectal dermoid, or a dermoid from the petrosal. The term "dentigerous cyst" had been applied to all these different tumours, and he ventured to point out, as Mr. Tomes did years ago, that the term was now used in a very loose manner, and had lost its original meaning. He thought the Society should set an example by discouraging the use of such a very objectionable term.

Mr. Storer Bennett said the case he wished to bring forward that evening, at the risk of giving still greater offence to Mr. Bland Sutton, was one he had ventured to

call a dentigerous cyst. The term was one which had become classic from long use, and for their purpose it described pretty well what they understood as cysts developing in the jaws, containing a tooth or a germ of a tooth. The case was that of a man 25 years of age, who came to the Dental Hospital about three weeks ago with a swelling over the right upper central incisor. On first seeing it he thought the tooth was dead, and directed that it should be drilled to clear out the pulp; but when the house surgeon found the pulp was alive, the swelling was diagnosed as a cyst, arising not from a dead tooth, but from some other cause. The cyst was opened and was found to contain an unerupted tooth. It had at one time been inflamed, and pus was evacuated when the cyst was opened. The man had no lateral in the alveolar arch : he had a canine and central incisor, and there was a smallish gap between the central and the canine. He stated that some few months back he had a small tooth with a short root extracted from that particular place with the idea that he would get rid of the swelling and pain, but no relief was produced. He then came to the hospital. An opening was made above the central, and the cavity containing a partly-formed tooth was seen. A considerable amount of fluid escaped. The tooth, which he took to be the missing lateral, was inverted, the crown pointing upwards and towards the left. It was somewhat loose, not very firmly attached to the bone, and the amount of root developed was very slight.

Mr. Constant was then called upon for his paper on Pental.

Pental.

By T. E. Constant, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng.

Mr. President and Gentlemen,—In bringing to your notice this evening a new drug for the production of general anæsthesia I am not acting without precedent, because so long ago as 1870 Mr. Woodhouse Braine exhibited, at a meeting of this Society, an anæsthetic that was then in its infancy. Nevertheless, it was with no little diffidence that I promised to comply with the request of your able and energetic secretary, Mr. Colyer, to read before you an account of my experiences with an anæsthetic into the physiological action of which I have had neither the leisure nor the ability to enquire. Since, however, Dr. Dudley Buxton has kindly consented to supplement my remarks by an account of the drug in its chemical, physical, and physiological aspects, I feel that what I have to say will not be altogether valueless, even if it be no more than the preface to a description that is certain to be highly interesting and scientifically accurate.

Pental is a new drug only as regards its name and the method of its preparation—it is, in fact, the amylene of Snow. The manufacturer claims for it a definite and unvarying chemical composition and a constant boiling point, while it is known that amylene was an uncertain compound with a very variable boiling point. Moreover, it is stated that pental, by the present process of manufacture, is quite freed from the impurities that were present in amylene, and which were supposed to have occasioned death in those cases in which the administration of the latter drug proved fatal. Those of you who are familiar with Snow's account of the effects of amylene will notice that however much pental may differ from it chemically, there is a striking resemblance in the results obtained by their administration.

Pental or isoamylene C_5H_{10}, or to be more correct, $(C.H._3)_2$ C.CH.C.$H._3$, is a colourless liquid of low specific gravity having a constant boiling point of 38° C. It is obtained from amylene hydrate by heating with acids. It is insoluble in water, but mixes with chloroform, ether, and alcohol. It is extremely volatile and inflammable. It has a peculiar and somewhat disagreeable odour, but is so little irritating that the pure vapour can be inhaled without the slightest discomfort. It is manufactured by C.

A. F. Kahlbaum, of Berlin, who sends it out in cases holding ten small bottles, each containing about five drachms.

The following account is taken verbatim from a short paper contributed to the *Journal of the British Dental Association.* It may be considered to embody my personal experiences up to date, because, for reasons that will presently be obvious, I have used pental but very occasionally since that paper was published, and not at all since the announcement in the *British Journal of Dental Science*, of December last, of three deaths due to its administration.

"In my early experiments with pental I endeavoured to induce anæsthesia by administering the drug by the open method. This I found most unsatisfactory. After administering it about half a dozen times I arrived at the conclusion that to produce the degree of anæsthesia requisite for the painless extraction of teeth some other than the open method must be adopted. This, my later experience, has been somewhat modified, for I may anticipate by stating that the most striking feature in connection with pental is, that anæsthesia sufficiently profound for the painless extraction of several teeth may be induced by it without the development of any of the indications that usually accompany such a degree of unconsciousness. Subsequent experiment has

convinced me that in the early cases referred to sufficient anæsthesia was produced for the purposes of the dental surgeon, although I was not then sufficiently acquainted with the peculiarities of pental narcosis to be aware of the fact. The open method, however, should never be employed —firstly, because it is very wasteful, both of the drug and the administrator's time; secondly, because there is usually considerable excitement before anæsthesia supervenes when it is induced by that method; and thirdly, because individual susceptibility to the drug varies so much that (in the absence of the usual indications of anæsthesia) it is almost impossible to know when the patient is sufficiently 'under' to render an operation painless. Of course, if the pental were pushed until the conjunctival reflex were abolished and muscular relaxation established, the last mentioned objection would be overcome. To do this, however, in some cases more than an ounce of the drug would have to be used, and the patient subjected to unnecessary risk.

"The first case in which I gave it for operation was that of a girl about 18 years of age. The apparatus used was one of the old-fashioned cone-shaped gas face pieces with inspiratory valve at the summit of the cone and expiratory valve about half way between its base and apex. I removed both valves and fixed a spiral wire, upon

which lint was stretched inside the face piece, so that by dropping pental through the opening left by the expiratory valve it would fall upon the lint. In this case the following phenomena were noticed :—After the first two or three inspirations the pulse became rather accelerated, but its force was undiminished. The face became flushed, and just before the termination of the administration the pupils became slightly dilated, the eyes fixed and staring, the lids being widely open. Respiration was unaltered. In three minutes from the commencement of administration the conjunctival reflex was lost, four and a half drachms of pental having been used.

" I then operated, although there was no muscular relaxation, extracting three roots of a left upper first molar, a second bicuspid and two roots of a right lower molar. The patient remained unconscious for about a minute after the teeth were extracted, coming to with a start and a vacant gaze round the room. For about half a minute the voice was slightly thick, after which time there was no indication of the patient's having been anæsthetised, except that the breath was strongly suggestive of pental. Throughout the whole administration, after the first two or three inhalations until within a second or two of the operation, the patient was very restless and excited, behaving much like one recovering from

ether administration. There were no after-effects, and when the girl was seen a few days later she expressed herself quite willing to 'take it again' if necessary. This case is fairly typical of all (about thirty in number) in which this form of apparatus was used, excepting that in the majority I operated before loss of the conjunctival reflex became manifest.

"It then occurred to me to attach a bag to the apex of the face piece, converting it into

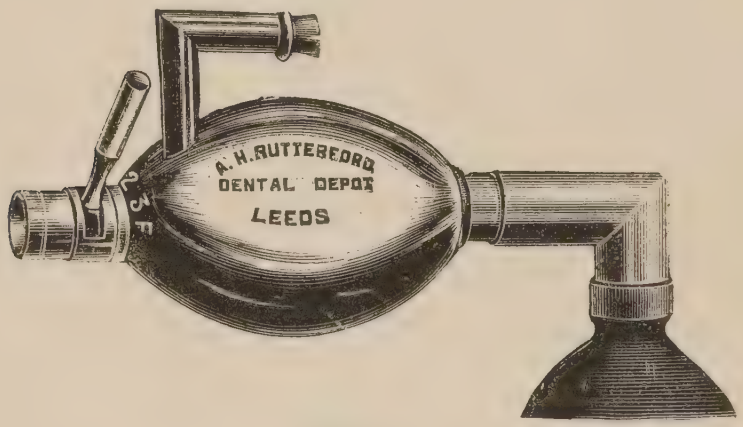


FIG. 1.

something similar to an Ormesby inhaler, the chief difference being that the pental was allowed to drop upon the lint during inhalation through the opening of the expiratory valve, instead of being previously poured upon a sponge, as in the case of ether administration. I then found that anæsthesia, sufficient for the extraction of several teeth, could be induced by this method in about ninety seconds, a little more than two drachms of

pental being used, excitement during its administration being very unusual.

"The next form of inhaler and the one I now use is that represented in the illustration, fig 1. I had previously used this for giving a whiff of ether with the gas when it was desirable to prolong the anæsthesia. Its construction is very simple. The oval chamber *A* contains the ether

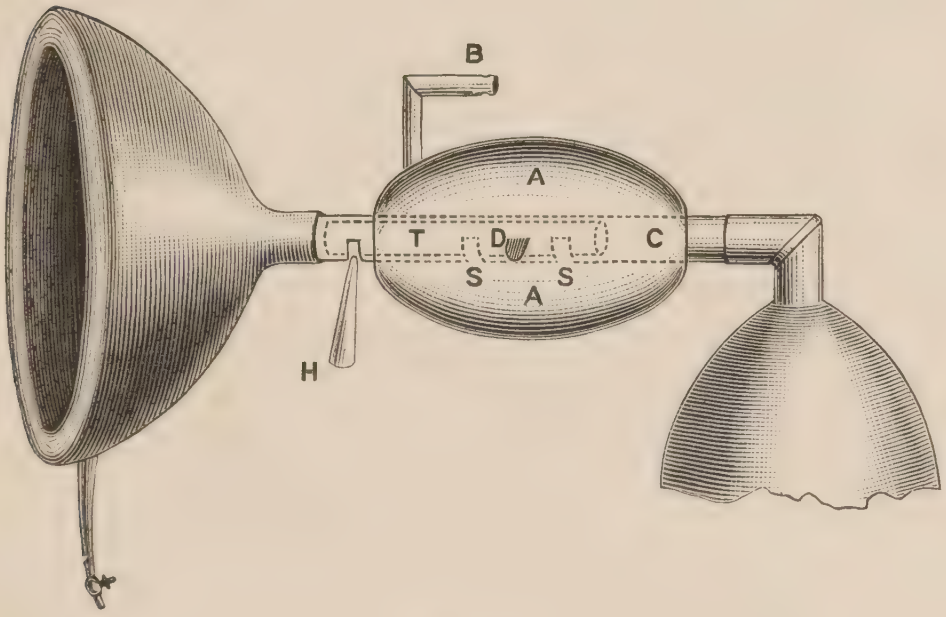


Fig. 2.

(or pental), which is poured into it through the bent funnel *B*. The central tube *C* runs right through the ether chamber, and the face piece is attached to one end of it, the bag to the other. Half way along it is a half diaphragm *D*, on either side of which are key-hole slots *S* and *S*, that form the means of communication between the

chamber and the inside of the tube *C*. Inside the tube *C* is another tube *T*, which fits it closely. This may be made to revolve within the tube *C* by turning the handle *H*, which is screwed into the inner tube, and passes through a slot in the outer tube. When the handle is turned in one direction the key-hole slots in the tube *C* are covered, and the patient would breathe into and from the bag, no air passing into the chamber. When the handle is turned in the opposite direction the inner tube revolves and uncovers the openings in the outer tube, and at the same time converts the half diaphragm into a complete one, so that the expired air from the patient passes through the chamber into the bag, inspired air retracing the same course. In intermediate positions of the handle, proportional quantities of air pass through the chamber, the rest passing direct through the tube *C* into the bag. With this apparatus the majority of the cases (about 180) in which I have used pental have been anæsthetised. The method used has been as follows :—About two drachms of pental are poured into the inhaler, the bag being detached and the handle turned to *O*. It is then applied to the face and the patient directed to breathe deeply, the bag being popped on at the end of an inspiration and the handle turned to a quarter on, the patient at the same time being told to breathe more

gently. If the breathing be *quiet* the handle is at once turned to 2, viz., half way on, and from ten to fifteen seconds later turned fully on for one or two inspirations, and then turned again to *O*, the patient being allowed to expire into and respire from the bag until nearly forty seconds from the commencement of inhalation, when, as a rule, the operation may be proceeded with ; the usual duration of administration being from thirty to forty seconds. The amount of pental used is from a half to nearly one drachm.

"Having thus far described the method of administration, I will now make some general remarks upon the results obtained with this apparatus, used in the manner described.

"In the majority of cases the following phenomena were noticed :—Almost immediately the pental was inhaled there was slight flushing of the face and quickening of the pulse, the increased frequency being unaccompanied by any diminution of force. Respiration, if quiet at the commencement of the inhalation, became deep and rapid when the handle of the inhaler was turned to full, but became quieter when it was turned off. The eyes, if closed, opened as the patient became anæsthetised, and had a fixed and staring look. The conjunctival reflex was rarely lost, although in some cases I noticed its absence after four or five inspirations, particularly if they

were deep. In a few instances there was profuse perspiration after about thirty seconds' inhalation. The duration of the anæsthesia produced was on the average of about one and a-half minute, but varied greatly with the patient and with the character of the respiration, never having been less than a minute or more than three; there was no muscular relaxation. Occasionally the patient's eyes would follow the movements of the operator; otherwise the patient remained quite still. In about five cases the patients declared they were perfectly conscious throughout, but felt no pain, and had no desire to move. There were no after-effects, immediate or remote, in any one case. I am speaking now only of those cases in which the pental was administered exactly in the way described above, that is, in all, between 130 and 140 cases. I will now describe a few cases in which the method of administration was varied.

"In two or three instances I have given it to patients who did not wish to be rendered unconscious, and on that account objected to gas. One lady, about 40 years of age, required the extraction of a left lower molar. I assured her that if she would do exactly as she was told I would promise to extract the tooth for her painlessly, but at the same time she would be sufficiently conscious to follow my instructions.

I used the apparatus described, containing rather more than two drachms of pental, but turned the handle on to full at the very commencement of inhalation. After the patient had taken four deep inspirations I laid aside the apparatus (the patient following my movements with her eyes), told her sharply to open her mouth widely (it was not previously propped), reached for my forceps which were lying on the bracket, and extracted without any movement or expression of pain on the part of the patient, although it was a difficult tooth to remove. A few seconds later, the patient, on being directed to rinse the mouth, seemed a little dazed, and had no recollection of the operation, but remembered my having told her to open her mouth.

"I have had three or four similar cases, but in those the patients remembered the extraction of the teeth, although there was no recollection of pain, and in no case was there struggling or noise. In a similar way I have extracted nerves from the front teeth, but in every case in which this was done the patient either felt pain or was completely unconscious. In only one case have dangerous symptoms been met with, but this is interesting as it indicates the great power of the drug.

"Being asked one day to administer it to a lady for the extraction of an upper tooth, I

found that I had only about three-quarters of a drachm left. Being anxious to insure anæsthesia I turned the handle of the inhaler on full, and allowed it to remain so throughout the whole of the administration. The breathing was very deep, as it always seemed to become when the concentrated vapour was inhaled. After the first few inspirations I knew by experience that the whole of the pental had evaporated. The administrator becomes aware of this fact by the sensation conveyed to the hand by which the inhaler is held, the inhaler becoming perceptibly colder at each inspiration, while it contains any liquid pental, ceasing to do so when it is empty. I was afraid, therefore, that the re-breathing of such a small quantity would be scarcely sufficient to induce anæsthesia. However, in less than thirty seconds the fixed gaze of the patient, together with a greater dilatation of the pupils than I had ever previously noticed, indicated the supervention of anæsthesia, although the corneal reflex still persisted. The face-piece was therefore removed, and the tooth extracted, the patient's respiration becoming markedly slower as soon as the tooth was removed, finally ceasing altogether about a minute after the removal of the face-piece. Coincident with the entire cessation of respiration, the radial pulse, which throughout the administration was un-

altered, became almost imperceptible. The patient was immediately inverted, which had the effect of restoring the pulse, but she made no attempt at respiration, and cyanosis was then first observed. She was therefore placed upon the floor, and artificial respiration was commenced, in spite of which the cyanosis deepened. The artificial respiration was, however, vigorously kept up for fully seven minutes before the patient initiated any respiratory effort, but when she did, recovery was very rapid. It was subsequently elicited that the patient was just convalescing from a severe attack of bronchitis at the time."

The above account was written in May last, since when I have only administered pental at the express desire of my patients, many of whom prefer it to any other anæsthetic they have taken. The only modification I have since made in the method of administration is by allowing the patient at first to breathe a more diluted vapour, that is to say, by turning the handle of the inhaler less rapidly to full. When this is done the administration lasts a little longer, and more pental is used.

One of the fatal cases referred to is so very similar to the case described above, except as to its unfortunate termination, that I feel I cannot refrain from quoting it. "A healthy, powerful,

navvy, aged 27, was admitted to the new General Hospital in Hamburg, with a crushed left forefinger which was amputated under pental. The pental was covered with waterproof material poured on the inner side of a small Esmarch mask containing sponge. Anæsthesia followed entirely without 'excitation' so that the operation could be finished after two minutes. When the mask was taken from the patient's face the eyes were opened, pupils tolerably wide. Suddenly the breathing became worse, the patient became cyanotic, and respired only once deeply: then the breathing ceased entirely, and with the cessation of breathing the pulse was imperceptible. In spite of artificial respiration, compression of the heart, tracheotomy and blowing in of air, death followed."

It will thus be seen that whatever may be the safety of pental as compared with chloroform, there can be no doubt that it is more dangerous than N_2O, and that the last-named agent should invariably be chosen for brief operations. Nevertheless, I am of opinion that those of the medical profession who are in the habit of administering chloroform for operations where N_2O or N_2O and ether could be used equally well, should give the preference to pental, because, even if it be no safer than chloroform (and personally I believe it to be far more so),

the ease of its administration, the certainty of its action, the rapidity of recovery after its use, and the entire absence of after effects, entitle it to a claim upon the consideration of those who deem chloroform a justifiable anæsthetic in dental surgery. This view, I see by the *British Medical Journal* of February 17, is taken by Phillip, who states that during twelve months, chloroform and pental were the only anæsthetics used in Kaiser Friedrich's Children's Hospital at Berlin, and that "judging by 1,000 narcoses, pental is with certain exceptions always able to replace chloroform, being less dangerous and without after-effects."

Discussion.

The President said they were indebted to Mr. Constant for bringing the subject of his paper under their notice. Anything likely to give a little more lasting anæsthesia than gas would be of very great advantage. He was sorry that Dr. Dudley Buxton, through illness, was not able to be present, but hoped that some gentlemen would be able to speak of their experience with this drug.

Dr. Prince Stallard said owing to the kindness of Mr. Constant he had come from Manchester to state what little experience he had had in the administration of pental. Before September last he knew little or nothing about it, but at that time their house surgeon one day produced a small bottle of pental and asked him to administer it. He did so, and not knowing in what way to try it, he first of all used the open method which, like Mr. Constant, he certainly would not advise anybody else to adopt. He tried it in fifty persons, all females, ranging in age between 13 and 43. The first was a girl of 22. It was administered on a napkin, similarly to chloroform ; it took three minutes to complete anæsthesia, and one and three-quarter ounces were used. She remained under one and a-half minutes. The eye reflexes were present during the whole time, with marked dilatation of the pupils. There was extreme distention of the capillaries of the face, similar to what was seen in the administration of nitrite of amyl. The breathing was normal, and the muscles perfectly placid. There was no headache, and she made a perfectly good recovery. That one case exactly demonstrated what occurs in the open method, and after trying it in six cases he abandoned it for the " Clover " inhaler. After four or five cases he found extreme contraction of

the masseter muscles: so much so that there was very great difficulty in opening the jaw. He then tried the use of a prop previous to administration, a practice which in the administration of pental, he must firmly condemn, seeing that in almost every case there was marked muscular rigidity, crowing respiration and laryngeal spasm. This, he attributed entirely to the penetrating action of the drug on the upper opening of the trachea. After this unhappy experience of giving it with the prop in the mouth, he left out the prop and gave it without, and found that opening the mouth with a Mason's gag was far superior to the other method. He used the ordinary Clover inhaler. It was very seldom necessary to go beyond three quarters, turning the indicator on to I., and the anæsthesia was very marked and very nice in every way. He had two accidents which, it was only just to state, caused him an immense amount of anxiety. One was in a girl, B. S., æt. 17, a dressmaker. It was given with Clover's inhaler, with gag in the mouth previous to administration. The pre-anæsthetic period took fifty seconds, and there was much stiffening of the muscles. After an extraction, whilst still under the anæsthetic, respiration suddenly ceased. He had not time to feel the pulse, but put her on the floor and did artificial respiration. He did not invert her, nor inject ether, nor use any means to stimulate the heart. Artificial respiration was used for two minutes when the long-wished-for sigh occurred, and she made a very good recovery. She was particularly asked whether she noticed anything about being moved out of the chair, or when she came round being on the floor, and she said, "No;" she was perfectly satisfied, and thought it was very nice. The second case was that of a girl, æt. 22. Pental was given by the "Clover" inhaler without the prop. The pre-anæsthetic stage was thirty-nine seconds. She was the most markedly anæmic female he had ever seen. Sixteen stumps were extracted, and there was absolutely no bleeding; no blood whatever was noticed from the sockets. Respiration stopped after she had been under seventy-two seconds. Artificial respiration was carried on

for five minutes. During this time it was noticed, and the same occurred in the first case, that the corset was extremely tight. It was ripped up with a knife, and she immediately began to breathe; breathing had absolutely ceased for a period of nearly five minutes. In private practice this would have been an extremely anxious case. These were all cases that had been done in a hospital.

Considering these two cases, he thought they should be extremely careful in giving the drug to anæmic females. It was known that in the administration of gas in anæmia, after the face-piece was removed, the anæsthesia frequently became deeper. The same thing occurred with pental. Notwithstanding these two cases he liked the drug extremely. It was easily taken; patients did not complain of the smell, or of after-effects, beyond a slight headache. In three cases there had been headache, which had cleared away in the course of half-an-hour. In one case vomiting occurred, but on inquiry it was found that the patient had partaken of a very heavy meal just beforehand. Naturally they were somewhat sceptical of a new anæsthetic; they liked their old methods and looked askance on anything that was new; but those who had administered this drug must agree that it was very serviceable for the extraction of several teeth. He had known of a case where fourteen teeth were taken out at one administration. It was also a great gain to have a drug not nearly so dangerous as chloroform, for while the two cases he had mentioned were very trying, a great deal was due to his inexperience in giving the drug. If chloroform had been given, and the patients had gone off into the same condition as during pental administration, no amount of artificial respiration would have brought them round. He looked upon chloroform for the extraction of teeth as an impossible drug, because chloroform should never be given unless the patient was lying absolutely flat, whereas in operations on the teeth it was a very great advantage that the subject should be able to sit up.

The mean age of his cases was about 23, the patients ranging from 13 to 45. Under pental the pre-anæsthetic

stage averaged 58 seconds, and the period of anæsthesia 89 seconds. Under gas it might be taken at 51, and the period of anæsthesia from 35 to 45. There was, therefore, a clear gain in the time given to the operator to do what he wished to do. With regard to rigidity, he found very little in the closed method, no air being given, and the patient being told to breathe deeply, just as in giving ether. In one case, that of a Polish Jewess, a very excitable woman—and those who had to do with the Poles knew that they were a very excitable race—she took it extremely well. In the case of one girl, aged 13, she was 32 seconds going under, and 63 seconds under the anæsthetic. She was a marked epileptic, a delicate, under-fed, diminutive girl, with marked epileptic fits. She took it extremely well, but in her case there was marked opisthotonos.

Mr. Constant, by his bold experiments in the use of this drug in private practice, had done great service to anæsthetists. Being asked to give a demonstration before the Manchester Odontological Society on November 7, he (Dr. Stallard) did so, and seven or eight teeth were extracted by members, all of whom were very much pleased with the drug—seeing that it gave them a much longer time; but the general conclusion come to was to let him go on a little bit further before trying it themselves.

Mr. Carter Braine said he had no experience in the administration of pental. One point that struck him was that there were so few signs of anæsthesia, and that, in his opinion, rendered the drug more or less a dangerous one. He was surprised to hear that the closed method had been adopted with the bag. It seemed that the air being so limited by that method might account for the cases in which artificial respiration was necessary. The odour of the drug was certainly very unpleasant; he should not like to inhale it on that account alone, and he could not understand how it was that patients did not complain of after-effects. He agreed with the last speaker that chloroform should not be given in dental practice with the patient in an upright position in a dental chair.

Mr. CONSTANT, in reply, expressed regret at the absence of Dr. Dudley Buxton. He should hardly have ventured to have presented the subject as he had done if he could have foreseen Dr. Buxton's absence, because he had only dealt with one side of it, and they would have liked to have heard something of its physiological action. With regard to the prop, they, as dentists, knew the great advantage of the use of that appliance, and he did not find the difficulty Dr. Stallard had spoken of. He had never had a patient complain of the odour, and many to whom gas had been previously administered said that as to the pleasantness of the anæsthesia there was little to choose between the two. As to the open method, he found it very difficult to induce satisfactory anæsthesia in a short time, and on that account alone he adopted the closed method with the modified "Clover." It was, however, a process of evolution, as he endeavoured to indicate in the paper. He believed that, contrasted with nitrous oxide, pental was an unsafe anæsthetic; but in the country more particularly, chloroform was so frequently given by medical men—even for one extraction—that he thought in an anæsthetic like pental they had an agent that could very satisfactorily replace chloroform. He had never tried it for a long operation, although he fully believed that for certain operations, even with a duration of half-an-hour, pental would be found satisfactory. He had endeavoured to place the facts before the Society without any bias, and from those facts he hoped members had been able to draw their own conclusions.

A formal vote of thanks was given to the reader of the paper, and to those who had brought forward casual communications.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

April 2, 1894.

MR. FREDERICK CANTON, M.R.C.S., L.R.C.P., L.S.A., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

The following nominations were read before the Society :—HENRY BARBERY ROWE, L.D.S.Eng., 7, Cavendish Square, W. (resident) ; GERALD BERTRAM WEBB, L.D.S. Eng., Guy's Hospital (resident) ; S. RALPH APTHORPE, L.D.S.Eng., 1, Tweedy Buildings, Widmore Road, Bromley, Kent (non-resident).

The following gentlemen having signed the obligation book, were admitted members by the President :—LEONARD BROWN, L.D.S.Eng. ; WALTER J. MAY, L.D.S.Eng. ; FRANK MORLEY, L.D.S.Eng.

The President announced that the following gentlemen had duly signed obligation forms :—FREDERICK HAYNES, 11, Hillmorton Road, Rugby ; PERCIVAL TOOKEY LEIGH, 6, Portland Crescent, Leeds ; C. HARRY ORAM, 13, Royal Crescent, Cheltenham ; EDWARD A. MANTON, 14, Grande Rue, Boulogne-sur-Mer, France.

Discussion on Root Filling.

Mr. Baldwin briefly recapitulated the various points of his paper read at the February Meeting.

Mr. W. H. Woodruff was afraid there was nothing he could add to the knowledge they had at the present time on the matter in hand. He might as well say at the outset that certainly since 1887 he practically never dressed a tooth. It was no doubt very bold to say such a thing, but he could assure all present that with that treatment, he had found superior results to what he ever did before under what he considered careful and continuous dressing. He could quite sympathise with gentlemen who were afraid to take up this course of treatment. He only began it in what he considered very favourable cases, and went gradually on until as he had said at the present time he never dressed a tooth. He must qualify that to this extent, that supposing a case came to him in an acute state of periostitis with pus flowing down, and tenderness, he opened up the pulp chamber, but did not attempt anything in the form of dressing until the periostitis had subsided. Of course the same thing applied if, on the first visit of his patient, he had not sufficient time to go into the case thoroughly. Mr. Baldwin said one thing had been gained by the advocates of immediate root filling, namely, that more thoroughness had been adopted in the treatment. It had resolved itself practically into treating the tooth at once in the vast majority of cases. If on the second visit of the patient, a root was found healthy having only been dressed once, would it not have been as well in such cases to have filled up at once on the first visit? That was one point which should encourage men to try immediate root filling. He quite agreed with what Mr. Baldwin had said with regard to thoroughness, but he asked what would become of the potential cavity supposing a temporary dressing was placed in the root? what would become of the contents of the cavity or the products of the inflammation beyond the apex of the root? Was it possible by any amount of dressing put in the root to get at the contents

of that potential cavity? It was very doubtful whether the cavity was ever properly reached, or whether the antiseptic placed in the root canal ever penetrated beyond. Of course he was speaking of cases without a sinus, in which antiseptics could not be pumped through. With regard to another class of cases, those with sinus, he could not quite agree with Mr. Baldwin because he thought the root should be thoroughly cleaned out, and if possible of course an antiseptic passed through the sinus, but after having once rendered the root perfectly aseptic it should be filled up at once, and the easiest practical way to deal with the sinus, if it persisted, was from the outside. Coming to some of the methods of treatment, he agreed with what had been said in advocating a sufficient access to the cavity. It was one of the most important things to be able to get fairly at their work, so as to pass the instrument down with no bend at all, or with the least bend possible. It was most essential that that should be done. On the other hand, he did not approve of enlarging the roots at one end to any depth down beyond where they could see where they were going to place their fine-pointed instrument. His reason was that they could not possibly get down to the extreme end of the pulp canal, because of the risk of passing the instrument right through the apex, and if they did not do that, there was very often the difficulty of leaving a square shoulder where the drill left off, and against which it was almost impossible not to stop in the treatment, the result being that the lowest portion of the root, the most important part in the whole treatment, was often left absolutely untouched and empty when the stopping was finished. Then again, instead of using hooks, he thought the better method of cleaning out the canal was with Donaldson's cleansers. They could be got further down. The cleansing should be done very carefully, passing the instrument carefully down and pulling the *débris* up. He agreed that much care ought to be expended, not only at that part of the proceeding, but later on in using any antiseptic, not to pump or force the *débris* through. This was another reason for deprecating the use

of drills, because that was a very likely method of forcing some of the *débris* through the apex. Then as to disinfection. His practice was to use peroxide of hydrogen. That seemed to be a very useful drug, and he had certainly obtained better results with it than with anything else. He had tried bichloride of mercury, but had gone back to peroxide. He was extremely careful always not to use anything which was a coagulant, and that was a point which had to be thought of. Anything which would coagulate the albumen, and so prevent the action of whatever drug they wished to use, should be avoided. After the root was perfectly aseptic, it should be thoroughly dried out with hot air. He always first filled his roots with a solution of chloro-percha using the red base plate and chloroform, that of itself being a germicide and antiseptic. After using this mixed to a creamy consistence on a very fine instrument on some particles of wool, he passed a point of hard gutta-percha to the apex, or even in some cases passed up a wire and left it there if the root was small. Upon that he put some oxyphosphate of zinc, sealing the roots, and the crown of the tooth could then be filled with anything they liked. There was occasionally a little tenderness about the tooth for a day or two, but it would nearly always subside. He did not remember a case having come back during the last twelve months in which he had to extract. There had been some little trouble, but after an application of iodine, a little local bleeding and so forth, the teeth had settled down and become satisfactory. Mr. Baldwin had dealt so fully with the advantages to the practitioner of immediate root filling that it was unnecessary to enter into that again. He had merely wished to emphasize the advantage he had found in his own practice, and to express his belief that if others would carefully follow in the same line they would be astonished at the results.

Mr. J. H. Redman said he had great faith in immediate root filling, though he could not go so far as to say that he never dressed a tooth; because in cases where pus was welling down the nerve canal, it was most important to

dress for a few days. The great point was the cleansing of the cavity, and he had great faith in the plan mentioned by Mr. Woodruff. For disinfecting, he used a solution of hydro-naphthol, which was one of the most perfect disinfectants that he knew of. It was perfectly harmless; it was not like carbolic acid producing an eschar, and it did not coagulate the albumen. After thoroughly cleansing he generally filled with Weston's non-irritating stopping mixed with an antiseptic. That could be packed most efficiently in a liquid condition, and packing it in with cotton they could get it well to the apical foramen without any fear of going through. The chloro-percha was apt to do that, and produced considerable irritation in some cases. After filling the root-canal he always, as Mr. Woodruff suggested, filled the upper part with oxyphosphate of zinc, and then finished with gold or amalgam. No doubt the great point to be aimed at in root filling, was to get free access to the canals, and that was a very great point in the treatment. In many cases he had seen cavities filled in dead teeth, where it must have been impossible to reach the canals. Many practitioners seemed afraid in such cases to cut away the structure of the tooth. He thought that was altogether a mistake, and would much rather cut away a good slice of the tooth so as to get free access to the root canals, than run the risk of losing the tooth by not being able to treat it thoroughly. He could endorse Mr. Baldwin's statement by saying that in the majority of cases he should advocate immediate root filling. If there was any tenderness after filling he used the fluid extract of Jamaica dog-wood, which had a far better effect than the tincture of aconite and iodine.

The SECRETARY read a letter from Mr. Grayston as follows:—

As I am too far away to attend the Meetings of the Odontological Society, may I be permitted to add my mite by letter to the discussion on root filling started by Mr. Baldwin, viewing it from the practical standpoint of every-day practice? Take a septic root without complications, cleanse it thoroughly with instruments, using in connection

therewith any of the antiseptics favoured by immediate root fillers, such as peroxide of hydrogen, perchloride of mercury, or carbolic acid. Where the root is clean and apparently sweet fill it loosely with cotton wool and seal up the cavity of decay with temporary gutta-percha. Now if this cotton wool is removed after two or three days, it will be found to smell very foully. Presumably this is due to the dentine giving up the odours of putrefaction, which it had previously absorbed. Is it a clean or scientific operation to cork up this malodorous vapour, by immediate root filling? Probably Mr. Baldwin is right in saying there is nothing to support the idea that the pericementum can ordinarily be infected through the substance of the dentine and cementum. It has been stated, however (I think by Mr. Kirby), that water can be made to go right through the solid structure of a tooth, and if this is correct, why not infectious vapour? But granting that the pericementum can only be infected through the apex of the root canal, have we any means of hermetically sealing this opening, with a certainty that it will *remain* sealed in the majority of cases? During the last twelve years I have tried many methods of root filling, and I do not know of one that can be called a perfect method. Many materials are difficult to insert, and the work being done—so to speak—in the dark, renders accuracy of manipulation doubtful. Some materials are easy to insert, and very perfectly fill the root canal for a time, but eventually they become absorbed, and they become porous, and they shrink. Given a clean and thoroughly disinfected root, good results are obtained, notwithstanding the imperfections of the root filling. In fact I am led to believe from experience, that given the above conditions, there is no operation in dentistry that will give such good results for imperfect work as root filling. But it is necessary for the root to be thoroughly disinfected, and we do not get this by the immediate method. I have practised the immediate method, and for the time, at any rate, had a success that astonished me, but I have no confidence in it as a method of general practice. I agree with Mr. Baldwin, however,

that an experience in immediate root filling is very valuable. Since the value of certain of the essential oils has been brought to the notice of the profession, notably the oils of cassia, cinnamon, and peppermint, the treatment of roots by "the dressing method," has been simplified and greatly improved. If one of these oils is used as advised by Dr. Harlan, the time spent by the patient in the chair need not be much in excess of that which would be occupied by an immediate operation, particularly if the treatment takes place at visits for other operations as well. I quite agree with the general principles advocated by Mr. Baldwin, and desire to thank him for his root filling of hydro-naphthol, French chalk and eucalyptus oil. It is new to me, and I shall certainly make trial of it.

Mr. F. J. Bennett said he had been for some time past waiting with some amount of curiosity to find how far immediate root filling would supersede other methods. He was satisfied that in Mr. Woodruff's hands immediate root filling was a great success. The practice appeared to be advocated upon two grounds: first, that it was a quicker method, therefore commending itself to the practitioner; and second, that it was a better method. As far as his own experience was concerned, he should have thought that it could not have been so easily proved to be a better method in the sense of doing the work more thoroughly, and Mr. Baldwin was hardly fair in saying that it insured a more thorough opening up of the root canal and a more thorough cleansing. It was a little hard upon their best class of practitioners, who for years had had plenty of success in the treatment of dead teeth, and must, in consequence of that success, have cleared out the roots thoroughly well; because if they did not do so, it implied that germs must be still there, and he could not see how germs could have been there if the teeth had gone on comfortably year after year; it must consequently be granted that the work was thoroughly done. The advantage of immediate root filling could only be put on the ground that it was quicker and therefore claimed to supersede the other method. He had in his old method of

treatment, which was not immediate root filling, found usually that it was more convenient to prepare the cavity one day and then leave it for a time, but he quite recognised that there were occasions when it was very desirable, if possible, to fill and complete a tooth on the same day. He was in sympathy with both parties. In some hands, no doubt, immediate root filling was a very excellent plan. There were two points he would mention in regard to Mr. Baldwin's questions. The first was that Mr. Baldwin did not consider that micro-organisms penetrated to the periosteum in any way through the substance of the tooth, that is to say, through the dentine and cementum. Mr. Bennett was not aware that the matter had ever been put to the actual proof of microscopic examination, but it should be as easy to demonstrate the presence of micro-organisms in the dentinal tubes of the root, as it was in a carious cavity, and his own opinion was that in such a specimen, micro-organisms of putrefaction would be found present in the dentinal tubes, and also in the cemental cells, and in that way would get to the periosteum. Otherwise, he could not explain that class of roots in which they found the apical foramen much reduced in size, or perhaps hardly visible, and three or four vascular canals penetrating the side of the root and passing inwards to the pulp cavity. These, and other evidences of extreme activity in that region, convinced him that there must be some irritation produced by the organisms passing directly through the substance of the root to the periosteum without going through the apex. The point was raised as to whether micro-organisms or antiseptics could penetrate into the abscess cavity when it existed. It was perfectly evident that they must do so. Abscesses exist in almost all chronic dead teeth, and undoubtedly those teeth were curable after being treated. He could only conceive it possible that they were cured by the destruction of the micro-organisms, and they could only be destroyed by the action of antiseptics. It might be said that although the antiseptics did not penetrate to the abscess cavity, yet the organisms being deprived of air dwindled and became inert. That

might be a possible position, but for his part he imagined that antiseptics did penetrate the abscess cavity. He had been very much impressed by the whole discussion, and had come to learn rather than to teach.

Mr. R. H. Woodhouse said there were one or two points that did not appear to have been touched upon. With regard to the three classes of cases for immediate filling, he could assume that where a nerve had been destroyed by arsenic and carefully removed, there was no reason whatever why the fang should not be at once filled and the opening closed so as to prevent any further contamination. In the second class of cases, where there was a sinus at the end of a fang, immediate root-filling might be adopted, every precaution being taken to remove all septic matter, and to get the antiseptic solution to pass through the sinus and thoroughly cleanse it. Even in those cases, however, where apparently success had been obtained, he had noticed a recurrence of the sinus, it might be at the end of a few months, or a year. The sinus having disappeared, there was a certain tendency for it to come back, thereby causing a good deal of disappointment. With regard to the third class of cases to which Mr. Woodruff alluded, although he (Mr. Woodhouse) tried to be a fairly plucky practitioner, and, he hoped, a careful one, he had not quite come to the position of filling such cases without a little preliminary treatment. If there was any discharge down the fang he was certainly very diffident about closing up the cavity, at all events for a few days, or if he did so he should warn the patient of the probable consequences. The iodine liniment had not been alluded to. In long standing cases where the fangs were very unhealthy and had been in that condition for some time, he found better results from the iodine liniment than from any other antiseptic he had yet used. It entered into combination with any albuminoids that might be present and certainly made them inert. He sometimes filled fangs with iodine liniment for two or three days, and such teeth as a rule went on extremely well, whereas with any other disinfectant he would have had a great deal of fear. After destroying the nerve and

filling the fang in the ordinary way he did not as a rule fill the tooth with metal for some time. It was always better to put in a gutta-percha filling for a few months or weeks; the pressure on the tooth was less. He used carbolic acid and oxide of zinc on cotton wool as a permanent root filling, if any root filling could be called absolutely permanent. The old practice of getting gold to the end of the fang was extremely good; but its application was so difficult that it was almost extinct, and he supposed would never be revived again.

Mr. J. F. Colyer said, like Mr. Woodruff, he was in favour of immediate root filling. He adopted it with great caution at first, but finding it was successful, he had now arrived at the practice of filling nearly everything by the immediate method. Mr. Baldwin had stated that pericementitis was more frequent after immediate root filling. He (Mr. Colyer) did not find that was the condition, and if he thought that by treating teeth by the dressing method he could get better results, he should certainly go back to it. He was rather inclined to agree with Mr. Woodruff that better results were obtained by the immediate method, and so long as that was the case he should continue to adopt it. He had been looking very carefully and anxiously for the results of some of his cases treated four years ago, but he did not remember any in which teeth had had to be extracted after filling by the immediate method. Immediate root filling had taught them to be very much more careful in the removal of *debris* from the canal, and in the treatment of roots. One point upon which he laid great emphasis was not to remove the *débris* from the root canal too quickly, for fear of pushing septic matter through the apex. The method of removing the septic matter he adopted was as follows: With a hooked Donaldson he removed the *débris* from the region of the orifice of the canal, he then introduced into the same part of the canal some peroxide of hydrogen, or other suitable drug on cotton wool wound round a fine instrument, and instead of employing a pumping action he used a slight rotatory movement, thus avoiding the risk of pushing

septic matter through the end of the canal. Having cleansed the orifice of the canal he next removed some more of the *débris* and again applied his antiseptic. By adopting this gradual method of removing the *débris* from the canal, he thought the risk of pushing septic matter through the apex was reduced to a minimum. With regard to the use of drills, like Mr. Woodruff he must certainly say he was not in favour of reaming the canal. He believed that a root canal treated without reaming could be filled much better, they did not get the shoulder near the apex, and the root filling could be passed nearer to the apex. Reamers were very useful where the dentine was thoroughly softened through contact with septic matter. One class of cases which he found very difficult to treat was those of large apices. He believed that rizodontrophy was occasionally useful in these cases, for if they thus filled a root where absorption was taking place the root filling would soon protrude through the apex, and so act as an additional irritant, and hasten the loss of the tooth. He should be glad to hear opinions as to the treatment in such a case. He had adopted the method spoken of by Mr. Brunton, of sponge grafting on two occasions, and with great success. Mr. Brunton, in such cases, passed right up through the apex into the apical space a sponge graft rendered thoroughly aseptic, and left it there. This certainly seemed to open up the method of treating these difficult cases. He would be glad to know if any member had had any experience of a combination brought before the Chicago Congress, namely, kalium natrium. The drug was applied on a fine instrument such as a plain Donaldson bristle into the kalium natrium and then passed straight into the putrid pulp. They often got a little frizzling, and, as a matter of fact, there was a good deal of heat produced. The idea was that the kalium natrium united immediately with the fatty material in the pulp and sterilised the root canal at once, the heat generated acting, to a certain extent, as a germicide. In experiments out of the mouth he treated three molars by this method, and it seemed to hold out the best hope of

treating such canals as those found in the buccal roots of upper and the anterior roots of lower molars. In one of the three experiments, a small bubble appeared at the apex of the buccal roots, and whether that would cause any trouble in a tooth *in situ* he could not quite say, but nevertheless there was a certain amount of effusion through the apex. He had tried it twice on teeth in the mouth, and in both cases it was a success. There was one drug that he was using rather more now than formerly, and he used it in preference to peroxide of hydrogen, viz., sodium peroxide, about which Dr. Kirk had written an interesting article in the *Dental Cosmos*. Its advantages were that there was a greater amount of oxygen available and that it readily united with the fatty material in the root canal, and so rendered the operation of cleansing the canals easier. The more he used sodium peroxide the better he liked it, and he got root canals aseptic very much more quickly than with peroxide of hydrogen. With regard to treating canals by the immediate method where pus was present, he did not think any immediate root filler under those conditions would think of filling the root. One of the greatest points in immediate root filling was to be sure that it was dry to the apex. Unless he could get the root canal thoroughly dry he should certainly not fill. But even when a certain amount of pus was present, if the peroxide was pumped through into the pulp sac, he saw no reason why it should not kill the micro-organisms that were present, and thus render the pulp sac inert. He mentioned the case of a medical man who had had a tooth treated for some months, cotton wool being put in to soak up the discharge coming down from a chronic abscess. He (Mr. Colyer) treated the case by the immediate method. That was three and a-half years ago. It was still perfectly sound and tight. The case was undoubtedly one of chronic abscess at the apex of a tooth, without a sinus. He could only explain it on the theory that the peroxide destroyed any organisms existing, and so rendered the abscess cavity inert. In drying root canals he always adopted the method of treating them thoroughly

with the hot air syringe, and after that with a root canal dryer, which he thought of great value. Another difficult point in practice was the treatment of buccal roots in upper molars, the roots of bicuspids, and the anterior roots of the lower molars. His method, when the canals were small, was to leave such canals alone. The question of drilling such canal did not commend itself to him, for he doubted if they ever got to the apex, while they ran all the risks attending the use of canal reamers. Such cases were better left alone; though, of course, he would prefer if possible to treat them thoroughly. He mentioned the paper recently communicated to the *Ohio Dental Journal* where the use of sulphuric acid in the treatment of such root canals was mentioned, it being maintained that by the judicious use of a fifty per cent. solution of sulphuric acid, applied upon a suitable instrument, a way could be gradually opened up the canal. The fact was that by introducing the sulphuric acid up the canal the dentine in the neighbourhood was softened. The plan was highly spoken of, and seemed worthy of trial. Root canals in which the pulp was semi-calcified were exceptionally difficult to treat. In cases where they were unable to remove all that remained of the pulp he was rather inclined to use the much abused drug, iodoform, on this principle, that it exerted its action, not so much by killing the organisms, but by combining with the ptomaines produced by the micro-organisms and rendering them inert. He thought iodoform was preferable to the sublimate, for the reason that sublimate produced such a discoloration of the tooth. He was glad to hear Mr. Redman speak in favour of the method of opening up the tooth and getting a thorough view of the canal. That was one of the great secrets in any method of root filling.

Mr. Thomas G. Read said he concurred as to the importance of opening the cavity so as to obtain free access to the pulp chamber, he did not believe in drilling out the canals, except well cutting away the constriction at the entrance of the pulp canal, thus forming it funnel-like in order to avoid the wringing-like action of the constriction

if left. He strongly objected to enlarging the whole length of the canals as they are usually quite large enough, and besides the chance of piercing the side, septic matter may be forced through the apex; this might be demonstrated by drilling out the canals of a freshly extracted tooth, when the apex was approached by the drill, a small worm-like piece would be forced out at the foramen. For washing out he preferred perchloride of mercury, three grains to an ounce of alcohol. The alcohol helped to dry the canal, and the perchloride was left in a thin layer on the inside. As a rule, he did not like syringing out canals, as septic matter might very likely be driven through the apical foramen, especially in lower cases. He was a great believer in the warm air syringe, which he used several times during the operation of washing out. With regard to the bristles sold, he said they were usually too thick and always too smooth, it was very awkward indeed to wind wool tight on a smooth bristle, and as it was introduced into the canal the point was uncovered, also there was a piston-like action easily produced, especially if the wool carried any fluid; in such a case the wool would jam against the walls of the canal, the fluid introduced would be squeezed towards the mouth of the canal, and the septic matter forced towards the apex. Bristles should be filed fine and roughened with a coarse file, then the wool could easily be twisted on and would stay where it was put on the bristle, and the piston-like action thus be avoided. With regard to root fillings, in most cases he preferred a thin solution of gutta-percha and chloroform, but in the few cases where all the pulp could not be removed, thin oxychloride of zinc seemed to answer very well. It was said by Dr. D. F. Whitten to turn the pulp tissue into leather and thus close the apex. He did not like the idea of leaving wool soaked in a solution of gutta-percha in the canal as mentioned by Mr. Baldwin, as he believed if a piece of wool was left in, the canal could not be thoroughly filled as the wool would jam against the walls and prevent the gutta-percha cone driving the solution to the apex. Having thoroughly painted the canal by means of a little

wool upon a fine roughened bristle with the solution or the thin oxy-chloride of zinc, a gutta-percha cone should be introduced, these should be made similar in size to the canal as wanted, and on being pressed home would act as a piston on the fluid painting and fill up the apex, it did not seem to do any harm if a little gutta-percha was pressed through the apex, but this was best avoided by watching the patient as the cone was pressed home. With regard to after treatment, patients now and then, had a little pain, and in such cases he recommended his patients mostly to take a couple of teaspoonfuls of Carlsbad sprudel salts in a little warm water on an empty stomach. It was a mild cathartic but seemed to answer well in such cases.

Mr. Storer Bennett said the successful treatment of roots entirely hinged on the question of their being cleansed. Whether by spending a long time at one single operation, they could render the roots and the apex aseptic and fill with gutta percha, or whether by successive dressings they ultimately achieved the same object made little or no difference. Although no doubt a very considerable amount of trouble had been taken by the advocates of immediate root filling, they claimed a little more than was perhaps intended, when it was said that they took such a very great amount of trouble in dressing their roots, and thereby attained a much greater amount of success. He agreed with his brother in thinking that a very large amount of exceedingly good work had been done for years, and was being done at the present time, by those who had never attempted immediate root filling. Referring to the use of such drugs as peroxide of hydrogen, peroxide of sodium, and sodium and potassium, no doubt they generated an ebullition of gas, and in using them there was very considerable risk of driving the putrid matter through the apex. They therefore, ought to be exceedingly careful how they used any of the drugs which did generate oxygen, and so might drive small portions of pulp through the apex. Mr. Baldwin seemed to lay rather more stress than he fairly ought on the care taken to open up the root canal properly by those who adopted immediate root filling.

There were a large number of practitioners who did gain access to root canals so as to see them thoroughly, and some few years ago, a paper was read by Mr. Hern in which he showed how he considered the root canals of various teeth should be treated. That was before the period of immediate root filling, or at any rate it was not the result of the teaching of immediate root filling. He would like to have some instruction as to the pathology of what Mr. Baldwin called the "potential cavity," and also of the "abcess cavity." He could not understand how when there was any kind of eating away of the bone, or erosion of bone at the end of a tooth which became filled either with granulation tissue or occupied by an abcess sac containing fluid—he could not understand how such a cavity could be washed out and dried so thoroughly that no discharge came from it, and that gutta percha or any other dry substance could be put into the root canal and produce a filling up of the bone cavity, or a safe condition of that cavity however it was brought about. As for the potential cavity being filled up with granulation tissue, he regarded that as hypothetical, but he would like a little more explanation as to what Mr. Baldwin considered the pathology of such cases to be. He wished to add his testimony to the value of the much abused drug iodoform. He was confident, no matter what scientific experiments might show out of the mouth, that clinically very valuable results were obtained from its use, and thought it only fair that whatever might be shown by bacteriological cultivations, as long as they got successful results in their operating rooms they should give the credit to the drug that it deserved, and he believed they would be quite safe in using it in a very large number of cases.

Mr. Beadnell Gill asked how they were to distinguish safe cases for immediate root filling, from those which were unsafe.

Mr. Baldwin, in reply, said he was not an immediate root filler of at all a pronounced type. His position was that a certain number of cases of dead teeth were certainly

safe to fill immediately, but others were not safe at all, and even those cases which were safe could not always be selected beforehand. If there was any serious doubt, it was better to defer the filling, or to put in a trial filling. With reference to the disinfection of the potential cavity, he believed it could often be done at once with peroxide of hydrogen or some volatile antiseptic ; or if not quite disinfected, it would be sufficiently so to enable the natural processes to deal with the micro-organisms. With regard to filling a tooth with a sinus immediately, and treating the sinus from the outside, he thought that pumping the antiseptic through was the most perfect method, if the cavity was fairly small. There were, however, cases where a cavity could not be washed out in that way, but must be considerably enlarged on the outside with an escharotic and a drainage tube put in. With regard to the use of nerve-canal drills he thought it better unless the canals were very large to use the fine drill as far as it would go with moderate pressure, taking care not to let it slip through the end. It should go as far as possible towards the apex because it made the canal easier to fill, and the stopping could be removed much more easily than if the canal had not been drilled. It was also the best way of removing particles from the canal, for sometimes a drill would get out particles that could not be got out in any other way. A Morey drill, if properly made, would not cut any shoulder whatever. The drill terminated in a probe point, and the cutting wings fined away to nothing, so that there was no shoulder possible. He agreed with Mr. Woodruff in considering chloroform a very efficient antiseptic, especially when mixed with eucalyptus oil. With regard to the frequency of extractions necessary after immediate root filling or treatment by dressing, he considered the two or three per cent. of failures sometimes spoken of enormously high. He should be inclined to put his own failures after filling dead teeth, which were found dead at about one per mille. It was exceedingly small, in fact, during the last four or five years he had never had to remove a tooth which was treated when found dead.

Teeth which had to be killed with arsenic came into a different category. The most dangerous teeth to fill immediately were the lower bicuspids, when there was any pus welling up through the root. Possibly that arose partly from the force of gravity being against any effective drainage. Oxyphosphate of zinc cement was a very good filling, but not so good as solution of gutta percha, *plus* gutta percha points, because it was more difficult to remove. If a tooth had to be crowned later on it was a great advantage to be able to get out the root filling immediately. With regard to the permeability of dentine and the possibility of forcing water through, he believed that water could be forced through any known substance, even wrought iron and glass, if sufficient pressure was used, but under ordinary circumstances, dentine and cementum together were not very pervious. The point he raised was not whether micro-organisms could travel along the dentinal tubules, but whether the peri-cementum could get infected that way, and he did not think it could unless there were pathological channels which existed only rarely. In the case of the abscess cavity his idea of the pathology was that very often there was an actual cavity filled with pus. In other cases the septic matter in the root canal produced a certain amount of periostitis followed by rarefying ostitis resulting in the removal of the hard structure of the bone, and granulation tissue being left; and in other cases again where there had been a large abscess cavity filled with pus it would, to some extent, fill itself up by the growth into it of processes of soft granulation tissue. In reply to Mr. Gill, he said the unsafe cases were decidedly those where there was pus or where they could not get satisfactorily towards the apex. Most of the other cases were very safe, but it was better to try them first before permanently filling.

The thanks of the Society having been accorded to Mr. Baldwin and others who had taken part in the discussion, the meeting terminated.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

May 7, 1894.

MR. FREDERICK CANTON, M.R.C.S., L.R.C.P., L.S.A., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

The following members were balloted for and duly elected as members :—RHYS PRICE, L.D.S.I., 252, Clapham Road, S.W. (resident) ; AUBREY H. FAREBROTHER, L.D.S.Eng., 3, New Street, Salisbury (non-resident) ; WALTER R. WOOD, L.D.S.Eng., 21, Old Steine, Brighton (non-resident).

The CURATOR said he had to acknowledge specimens presented to the museum by Mr. E. Lloyd-Williams and Mr. Oswald Fergus. The model presented by Mr. Lloyd-Williams showed two extremely interesting second lower bicuspids, taken from a boy aged 14, the left one being inordinately large, and very much distorted. One would be glad, if possible, to find it necessary to extract the tooth, but, unfortunately, it could not be shown from any carious condition that it was absolutely necessary to intervene. The model itself was extremely interesting, and they

were very much indebted to Mr. Williams for presenting it. Mr. Oswald Fergus had sent a specimen of a lower molar with a very large crown and disproportionately short and slender roots. There was also a right lower molar, only a small portion of the neck of which protruded from the gum. On the removal of the tooth it was found that the roots were united by exostosis. There was also an upper molar removed, on account of necrosis and absorption of the alveolus over the two buccal roots. Lastly, there were three specimens of inordinately-sized roots, which were also very interesting.

The Librarian reported that the Council of the Royal Medical and Chirurgical Society had willingly consented to exchange their Transactions. He also reported the receipt, by purchase, of the "Atlas of Pathology of the Teeth," second edition, by Professors Heider and Wedl; "Crown and Bridge Work," third edition, by Dr. George Evans; "Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 1894."

Mr. S. J. Hutchinson said he had been asked by Mr. James Rymer, of Brighton, to exhibit an extremely interesting photograph of a patient, showing very greatly enlarged central incisors, and also the incisors themselves which he had extracted. He thought members would agree that Mr. Rymer had adopted the right course of treatment. Having first removed the two central incisors he was also careful to remove as much as possible of the anterior alveolar plate, in order to reduce as far as possible the deformity caused by the prominence of the incisors. The particularly interesting part of the case was that the excessive size of the incisor teeth appeared to be due to the gemination of a supernumerary tooth with the ordinary central. He had not made any section across the tooth, not liking to do so without Mr. Rymer's permission, but there was a very obvious line of demarcation up to the roots of both of these central teeth, seeming to indicate that a supernumerary tooth had become geminated with the two central incisors. That would not account for the excessive length of the teeth, but it would

account very thoroughly for their excessive width. There was a very light portion and two dark portions, and he thought a section through the root of one of those teeth would show either two distinct nerve canals or else a dumb-bell-shaped nerve cavity. If that were done it would set the matter at rest. At present they could only get the naked-eye appearance, but on holding the teeth up to the light what he had described would be plainly seen. They were two very interesting specimens, and they were very much indebted to Mr. James Rymer for presenting them to the museum.

Mr. Hutchinson also exhibited an electric lamp which had been sent to the Society and which appeared, he said, to be a very effective arrangement. It went up and down an upright and could be fixed at any height. It gave a very diffused light, and the most interesting fact was that there was no shadow of the filament, the shadow being always a detriment to the use of the incandescent lamp.

Mr. Oswald Fergus exhibited an apparatus known as the "dental phantom," devised to aid students in the earlier period of their study. At a certain time in their career students were expected, and rightly so, to practise experimental dentistry, though not perhaps on their fellow creatures. This was carried out either by drilling suitable cavities in bone or by putting extracted teeth into the jaws of a vice. Both of these methods were good as far as they went, in giving men a certain amount of familiarity with instruments and materials, but they were deficient in the fact that the student had not the surroundings that he had with the patient, and therefore, was perhaps apt to learn bad habits. The appliance consisted chiefly of three parts. There was an upright upon which could be planted two representative jaws, each being fitted with a gutter, and into this gutter the teeth that had been extracted were placed. He would suggest that if the operation of extraction was to be practised the material into which the teeth were to be fixed might be "stent" or some other composi-

tion; for filling, ordinary plaster of Paris would be found on the whole preferable. Almost any operation on the human mouth might be attempted with this appliance. There was in addition an elastic band which went round both jaws, forming an artificial cheek, so that the student was really surrounded more or less with the conditions met with in actual life.

Mr. Storer Bennett drew attention to one point in connection with the dental phantom described, namely, the advantage of the student being compelled to work on the upper teeth without holding the specimen upside down. Of course the difficulty of treating an upper tooth was considerably increased when it was in its normal position with the cheeks obscuring the view. By this apparatus the student was taught to work under those circumstances which were likely to present themselves when operating on living tissues.

Mr. J. F. Colyer brought forward a case of an interesting swelling in the lower jaw. The patient was in attendance and could be examined by members. He was a boy of 17, and the swelling which was on the left side ran from the base of the coronoid process as far forward as the second bicuspid tooth. The outer plate of the mandible was bulged out much more than the inner, the swelling being fairly-well defined. On the superior boundary of the border of the jaw fluid could be felt very distinctly. On the inner side there was a fairly globular swelling, presenting a sharp margin of bone, and keeping the finger well beneath there was well-marked fluctuation. He had had the swelling aspirated, and Mr. Nicoll, who very kindly examined some of the cystic fluid, found a large amount of albumen present but no cholesterin. The growth was of eighteen months' duration, and twelve months ago, according to the patient one of the back teeth came out, followed three months afterwards by another molar. The swelling was certainly a cystic one of some kind. It did not appear to be a unilocular cyst, but it was possibly one of those cases of multilocular cystic tumours, or more

correctly, epithelial odontomes, the only point against that view being that the patient was rather young.

Mr. Gartley exhibited specimens of lower centrals and bicuspids incrusted to an enormous extent by tartar, and also a good specimen of calcification of the pulp. The patient had had considerable trouble with the tooth for ten years, it having been frequently filled. She complained of sudden "flashes of lightning" going through the tooth, but on examination he could detect no fault with it in any way. For a day or two after refilling it was quiet and then these symptoms came again. At last the tooth became very loose, and he took it out and splitting it open found calcification of the pulp. He added that she had refused to have the pulp extracted from the tooth. He also exhibited a specimen of exostosis in an upper molar. There was a doubt whether it had been a supernumerary tooth becoming united with a large bicuspid, or whether it was a separate fang belonging to the tooth. It had no connection with the crown. The bicuspid was all bound up with tartar. A piece of the tartar broke off and revealed the existence of the extra root on the buccal surface. The patient, a lady, had suffered with neuralgia all her life.

Mr. Bland Sutton exhibited a carious molar with pus-sac.

The tooth, a first permanent mandibular molar of the right side, had its crown greatly destroyed, and the pulp cavity widely exposed by caries. A pus-sac was connected with each root, but one was no larger than an apple pip whilst the other was as big as a pigeon's egg.

The specimen was removed by Mr. Chas. H. Watson, from a lad 14 years of age. When the boy came under observation he presented the conditions usually associated with alveolar abscess. There was considerable swelling on the right side of the mandible in the neighbourhood of this tooth. When it was extracted, to Mr. Watson's surprise he found this large sac dangling from the root. The sac was full of pus.

It was the largest pus-sac connected with a tooth-root that Mr. Sutton had seen. The specimen was preserved in the Museum of the Middlesex Hospital.

FIG.—An unusually large pus-sac connected with the root of a carious first permanent mandibular molar.
(Natural size.)

THE RETENTION OF ARTIFICIAL DENTURES IN EDENTULOUS LOWER JAWS.

The discussion on this subject was opened by Mr. DAVID HEPBURN, who spoke as follows:—

Mr. President and Gentlemen,—It is the wise custom of this Society from time to time to dispense with the formality of a paper and in lieu thereof hold an open discussion upon some subject of general interest to dental practitioners. Lately an ably introduced and important discussion has taken place in connection with the surgical side of our special work and this evening has been set apart for the consideration of a subject purely within the scope of that department of practice which comes under the head of Dental Mechanics. The subject before us is "The Retention of Artificial Dentures in Edentulous Lower Jaws."

Your Secretary has done me the honour of inviting me to open this discussion, and I imagine I am right in conjecturing that we have not to deal with those every-day cases which present no special points of interest or difficulty, and which may be treated in various ways according to accepted principles, but rather to confine ourselves to the consideration of those cases of peculiar difficulty which present themselves happily only from time to time, which cause much uneasiness to the patient, are a special tax upon the patience and ingenuity of the practitioner, and which for want of a more elegant term we may call "slipping lowers."

The subject is so essentially practical that in undertaking to bring it before you I have been exercised to know how to surround it with the interest it deserves, more especially as I am unaware that its varying aspects have hitherto been formulated, but my remarks will be as brief as possible consistently with the importance of the subject, and your discussion will, I doubt not, supply the interest which I myself may fail to impart.

The difficulty then upon which, by our discussion, we wish to throw light is that which reveals itself when a patient, probably advanced in years, seeks the aid of the dental practitioner with a view to obtaining artificial aids to mastication, all the natural teeth being lost and not even the roots remaining. A set of artificial teeth is adapted, and hopes of success are entertained on both sides, but as the early days of trial progress, it is found that the lower denture has a tendency to slip forward and protrude, and as it does so the mucous membrane is irritated in particular regions causing much pain and more or less ulceration. These symptoms are relieved by filing, or "easing," as it is called, the denture, and for a short space of time a certain degree of comfort may be secured, but shortly fresh spots of ulceration appear and the relieving operation has again to be repeated, and this goes on until eventually the denture becomes obtrusive by its forward movement, and the whole original adaptation of the articulation is disturbed. The case may be commenced *de novo*, but with the same unsatisfactory

result, and it may only be after many weeks of patient endurance on the one hand and patient work on the other that some end to the trouble arrives by the denture finding a resting place far away from its original seat, by slipping forward to lie in the sulcus between the anterior surface of the maxilla and the inner lining of the lip. Such cases have doubtless occurred, happily they may be rare, in the practice of most of us.

What, then, are the conditions leading to this result?

At the risk of being wearisome let me recall to your minds a few simple facts connected with the anatomy of the lower jaw which have a direct bearing upon our subject. The inferior maxillary bone varies much at different periods of life. It consists of a curved horizontal portion, or body, and two perpendicular portions, the rami, which join the posterior portion of the body on either side. At birth the rami join the body at an oblique angle. As maturity advances and up to middle life the obliquity of this angle diminishes until the junction is rectangular. With advancing years, however, the original obliquity is gradually re-assumed, and in extreme old age the angle of the jaw, returning as it were to its second childhood, assimilates the condition which it originally presented at birth. It is this obliquity in its more exaggerated form which plays an important part in rendering the inferior maxilla intolerant of the presence of artifical dentures.

Accompanying these changes we have in advancing years, and in some cases earlier in life, the entire disappearance of the alveolus, that portion of the jaw which seems to be wholly subservient to the presence of the teeth, it being non-existent in the infant jaw previous to the eruption of the teeth, strongly developed in middle life so long as the permanent dentition is retained, and again absent in extreme old age, when the natural organs of mastication have disappeared, or represented merely by a more or less elevated ridge along the superior border of the body of the jaw, covered with mucous membrane of greater or less thickness and fibrosity.

Comparing, then, the normal adult jaw with the one

typical of old age and viewing it laterally on its external aspect, we will notice the position of the mental foramen. In the first case, it is mid-way between the superior surface of the alveolus and the base of the jaw; in the second, the alveolus having disappeared it opens close to the superior surface of the body of the jaw at which point its nerves and vessels spread out directly to the mucous membrane. Of this there may be only a sparse covering, thus rendering it peculiarly sensitive to the continued pressure of a foreign body such as an artificial denture.

Again viewing laterally the internal surface of the inferior maxilla we will observe the position of the mylo-hyoid ridge for the attachment of the muscle of that name. It is practically midway between the superior surface of the alveolus and the base of the jaw. In the jaw-bone of old age, or where extreme absorption has taken place, it is, for a considerable part of its course, almost on a level with the superior surface of the base, thus creating a region peculiarly intolerant of pressure, not only from its sparse covering of mucous membrane, but also by the movement of the muscle attached to it.

Another point to be noted on this aspect of the jaw is the group of genial tubercles, four in number and situated on the inner side of the symphysis for the attachment of the genio-hyoid and genio-hyoglossi muscles. When extreme absorption has taken place these tubercles, often merged into an indefinite mass, form, with their tendinous attachments and superjacent structures, a prominence upon which no denture can rest. Indeed, sometimes they seem to persist until they appear to form the highest point of the superior surface of the jaw. When such is the case they create the existence of an inclined plane anteriorly, and it is from this eminence that a denture will often slip in a downward and forward course until it rests in the sulcus of the lip.

In addition to these immediate aspects of the body of the jaw itself with its membranous covering, we have conditions of mobility permitted by the temporo-maxillary articulation which differ from, or rather are an exaggeration of, those

which this joint is capable of performing during the period when the natural teeth are still existent. These altered movements are not favourable to the retention of artificial dentures. It is needless to refer to the various structures of the joint itself, suffice it to say that in the normal action of opening the jaw the condyle leaves the glenoid cavity and slides on to the eminentia articularis. As most bony eminences become modified with advancing years so it is with this one. Indeed, on examining the skulls which I have on the table (ages 73 and 78) it will be seen that the particular eminences referred to have in great measure disappeared. Thus in opening such jaws greater sliding movement exists. This, combined with general laxity of the muscles, and the absence of the more definite articulation which the presence of a full natural set of teeth would indicate, allows all the movements of the jaw to become exaggerated more especially the backward and forward movement. This tends greatly to the displacement of dentures.

Further all these senile changes are frequently associated with alterations in the spinal column ; this losing its original curves assumes the arched form. Thus to the head is imparted a fixed downward and forward position which causes the jaw to rest most naturally in a state of protrusion. By reason of this the space posteriorly between the upper and lower maxillæ is, in consequence of the oblique ramus, reduced to a minimum. Therefore, when artificial teeth are present the tendency is for the back blocks to come in contact unduly and so cause the whole arrangement to be tilted and displaced.

Affecting also the lower denture we have the muscular force of the tongue. This active organ seems to retain its power to the last even when the counteracting action of the cheeks and lips is practically absent in consequence of a wasted and flaccid state of their muscular tissues.

Finally, apart from these physiological and anatomical adverse changes, another set of difficulties, the accompaniments of age, have to be contended with, intolerance of pain, inability to control the movements of the jaw, and many others, but to these I need not refer.

The points I have endeavoured to emphasize may exist separately or combined and in all modifications, and I am aware that it is not only in the aged that many of them are to be found, but I have chosen to describe the extreme case, feeling strongly in my own mind that the first step towards successful treatment is the intelligent appreciation and recognition of the adverse conditions with which we have to contend. Before leaving this part of my subject, therefore, let me sum up what appear to me to be the main features inimical to the presence of artificial dentures in this class of edentulous lower jaws.

(1) The almost complete or total removal by absorption of the alveolar ridge.

(2) Abnormal thinness and sensibility of the mucous membrane.

(3) The presence of ridges or bony prominences sparsely covered with soft tissue.

(4) Extreme obliquity of the angle of the jaw, causing diminished space posteriorly between the upper and lower maxillæ.

(5) Undue and uncontrollable movements of the temporo-maxillary articulation.

(6) Protrusion of the lower maxilla, due to senile curvation of the spine.

(7) Inimical action of the tongue, uncontrolled by resistance of muscles of cheek and lips.

Lastly, I would mention an easily recognised and distinct variety of case not associated with extreme age, but with extreme absorption, where the muscles retaining their full power and perhaps being abnormally developed, tend forcibly to lift dentures from their position on the remains of the ridge.

And now, gentlemen, with regard to treatment my remarks must be very cursory. Consequently, I will merely touch lightly on those points upon which I hope you will enlarge.

Provided, then, that careful impressions of the parts have been obtained, the most natural antagonism of the

maxillæ ascertained by the usual methods, and suitable dentures designed, the question presents itself as to the employment or non-employment of spiral springs as means or aids to retention. I would suggest that, wherever possible, these adjuncts should be dispensed with, as by reason of the inclined plane presented by the surface of the lower jaw, and the confined space open for their action, they may tend to displace to a certain extent the lower denture. This is obvious, considering the direction of the thrust which these conditions create. At the same time I believe there exists a certain class of case where the employment of springs is indispensable. Typical of such are the cases I have endeavoured to pourtray in my diagrams. In such the retention of the upper denture by means of suction power may prove impossible.

When, therefore, the necessity arises for adopting springs, with their concomitant swivels, certain points must be adhered to.

In view of the limited space offered at the posterior part of the mouth for their reception, both by the proximity of the maxillæ and the intrusion of soft tissues, they must be brought well forward. Further in lieu of placing the lower swivel slightly in advance of the upper one as in ordinary cases to provide for the opening and closing of the jaws, they should at the outset be placed in the vertical line, and in this position they should be *blocked*. By "blocking" I mean they should be confined in their action by inserting "pegs" or "stops" in proximity to the swivel heads. By this means the direct thrust of the spring is maintained, even in the backward and forward movement of the jaws. Deeply cut chambers will sometimes suffice for this, but frequently there is no room to permit of their presence. The blocking provides also against the contingency of the springs irritating the soft tissues at the angle of the jaw as it turns upwards towards the coronoid process. Thus judiciously arranged springs will often act efficiently as means of retention, not only of the upper, but also of the lower denture in those cases where the stability of the one depends upon the existence of a fixed point in the other.

The consideration of the adjustment of spiral springs would, I know, form a theme in itself, but on this head I must content myself with these few remarks.

Dental surgeons will receive eagerly any suggestion which tends to obviate the slipping of lower dentures, and by the kindness of Mr. Lennox, of Cambridge, I am able to-night to show you his ingenious contrivance designed to this end. It was, I believe, first shown by him at the meeting of the British Dental Association at Exeter, and the arrangement is so simple and original that I will not attempt to describe it, but will simply pass the example, which he has been good enough to lend me, round for your inspection. Mr. Lennox tells me that an old lady, aged 93 years, has for four years used, with perfect comfort a set of teeth fitted with the device. This is great testimony in its favour. In the particular specimen now exhibited there appears to be no marked approximation of the maxillæ in the posterior region, but it is obvious the device could easily be adjusted to the minimum space, which is a great advantage.

The most heroic treatment is that suggested by Mr. Dall, of Glasgow, who has written to me expressing his regret at his inability to be present at this meeting. As you are aware, the main feature of the treatment consists in the creation, by operation, of sockets suitably located in the body of the jaw. Into these sockets pivots or posts attached to the under surface of the denture are inserted by means of which the sockets are permanently maintained, and stability of the denture secured. Mr. Dall has devoted much time and attention to this mode of treatment, and in writing to me, he says : "I would gladly send my models, but as they need explanation which I alone can give, I think it is better to withhold them, as they might only cause some misunderstanding. As yet, I have little more to say on the subject since I brought my method before the Birmingham meeting, but I am watching with interest the same cases within my reach, taking impressions occasionally to see how they progress, so that when I bring it forward again at some future date, I shall be able to say more fully where I have succeeded and where I have not."

Under these circumstances, and especially in the absence of Mr. Dall, I refrain from enlarging on this subject, but I am sure all present will feel gratified to know that Mr. Dall is still pursuing his experiments, and that there is a prospect at some future date of hearing more concerning them from his own lips.

Let me pass on, then, to another method, namely, that of "weighting" lower dentures to ensure stability. I believe that in one class of case I have referred to, namely, that in which the reflections of strong muscles tend to lift dentures from their place, the principle is one of greatest service and will often bring about most gratifying results. I have, however, in my own practice, encountered a case where, so strong was the muscular resistance, that after prolonged trial on the part of a most intelligent patient a heavily weighted lower plate of artificial teeth had to be discarded. A well defined ridge existed, combined with a favourable bite, but so strong was the resistance that, although all superfluous edges were removed, the denture was no sooner applied than it was lifted bodily up to float loosely in the mouth like a storm-tossed vessel in an angry sea. In the majority of such cases, however, time and patience will work wonders, and the principle is one well worthy of all consideration.

With a view to obviating the distressing pain caused by pressure on the mucous membrane, various means may be adopted with possible success. Amongst these I may mention lining the denture with gutta-percha. I have in my own mind at this time one case out of a number where this process was employed with distinct benefit. As absorption progressed (and it never ceases), layer upon layer of gutta-percha was added until the denture measured more than an inch in height. The mucous membrane became absolutely tolerant of it and stability was secured. The disadvantages, however, of gutta-percha are great, mainly the impurity which it acquires after prolonged use. Another method also worthy of mention is that of setting up the denture on a base of "soft" or better still "velum rubber." The velum rubber should be baked in type metal moulds to

ensure a smooth surface, and the baking process occupies six hours. The metal moulds require some ingenuity for their construction, but the immediate result of so soft and pliant a base applied to a sensitive mouth is distinctly good.

The perishable nature of the base, however, and the impossibility of paring it away without destroying its surface should ulceration occur, detract much from its advantages. On the whole an ordinary vulcanite base, made as narrow as possible with well rounded edges, and well strengthened if necessary, seems the most serviceable medium in the majority of cases.

And now, in conclusion, a few words of my own experience in the treatment of these fortunately rare cases, so far as obtaining the most favourable articulation is concerned. I believe the difficulties can only be overcome, or at least a certain measure of success attained, by personal adjustment of the denture to the mouth itself through repeated trials. Consequently, during these initial stages of "fitting," frequent visits at short intervals on the part of the patient are absolutely essential.

Having thoroughly ascertained by examination the various aspects of the case, and having formed a prognosis as to the probable difficulties which will arise, impressions should be taken, preferably in plaster of Paris. When these are cast and trial plates prepared, the proximate articulation should be taken, with the head in the upright position, or bent slightly forwards. Thus we are likely to obtain an indication as to the most forward position which the lower jaw can assume without undue effort. To this "bite" the upper denture may be made, and the lower one set up in wax, keeping the lower front teeth well within the upper, both as to position and height.

If springs are to be used they should be temporarily adjusted, and the arrangement then tried in the mouth, changing the position of the swivels if necessary.

Almost invariably this articulation, notwithstanding the precautions employed, will be found at fault, the lower denture having slipped forward, as it is bound to do, causing

forcible impingement of the lower front teeth against the upper ones. I should then slightly cover the crowns of the teeth with a thin coating of pink wax dropped upon them in a molten state and reinsert the dentures while the wax is still very soft, requesting the patient to close the teeth so as to mark the antagonism. Taking the dentures out of the mouth they should next be united according to the indication thus obtained. I would then set the lower plate, while the two are still united, in a bed of plaster and make a movable overturn of the upper as shown in the accompanying specimen. Discarding the original models the bite may be finally adjusted to this articulation, the position of the teeth alone being thus modified while the relation of the base to the mouth remains unaltered. The teeth, in doing this, should again be set well back and no prominent cusps allowed to interfere with the free gliding of the jaws. In the posterior region vulcanite blocks are often preferable to teeth, and in the upper denture additional canines in the place of first bicuspids allow of freer movement without tilting.

Success, I believe, depends mainly upon judicious allowances being made for eccentric movements, not only of the denture on the jaw but also of the jaw itself. And now, Mr. President and gentlemen, having trespassed already too long upon your time and patience, with a few explanatory words concerning my diagrams and specimens I will leave this wide and interesting subject in your hands.

The PRESIDENT said the Society was greatly indebted to Mr. Hepburn for bringing this subject forward. It was one that they all took an interest in, and they would be glad to hear any further suggestions of a helpful kind from members.

Mr. LAURENCE READ said the question of leaving a polished surface on velum rubber referred to by Mr. Hepburn, was a matter in which he took some interest, and which he had worked at considerably some six or seven years ago. He had now reduced it to a very easy mode of working, and the difficulty Mr. Hepburn spoke of, which was at one time very great, had been quite overcome. His mode

of treatment was to take a large piece of steel wire about a quarter of an inch thick, to make it red hot, and wherever they wanted a rough surface polished to run it along, which took off the rubber, as if it were being fused. If it was then treated with a little chloroform on wool a beautiful polished surface was left, just as if it had been baked on a metal mould. The soft rubber baked at the ordinary temperature was in every way satisfactory. He had had some of these soft rubber linings worn for seven years which were perfect in every way, the patients being delighted with the change from hard rubber.

Mr. Coxon, by means of diagrams on the black board, showed a method of adjusting swivel bolts in such a position as to be absolutely opposite one another. The device consisted of mounting the swivel on a gold carrier which could be moved backward and forward in a socket fastened to the plate. He was going to bring the matter before the Society at the next meeting, but thought it would be well to mention it, as it had some bearing upon the subject of the paper.

Mr. F. J. Bennett said the model shown by Mr. Hepburn and explained by him as representing an oblique condition of the lower jaw, an inclined plane being formed, would, he thought, bear another interpretation. Undoubtedly, as it stood, there was an inclined plane, but he doubted whether, in nature, they ever got a condition, if left to itself, of an inclined plane. If artificial teeth were placed in the mouth it might be so, for the jaws were kept widely apart, but if they were approximated without artificial teeth there was no longer an inclined plane; the lower jaw came up and was perfectly parallel with the upper one. This would give a hint as to how these cases should be treated. Finding that the more the lower jaw was approximated to the upper the less the plane inclined should teach us to make the plates as shallow as possible; in that way the inclined plane was reduced to a minimum. With regard to the drawings exhibited, although artistic, he doubted whether they were altogether anatomically correct. In one of them the ascending ramus was much too high. He wished to refer to the curious condition found as age

advanced ; the lower jaw became proportionally much larger in its arch, and the upper proportionally much smaller, so that whereas the jaws were tolerably equal in size in middle life, they found in old age a very small upper and a very large lower jaw ; consequently the upper plate had to be so arranged that the teeth stood obliquely forward, and the lower plate with the teeth obliquely backward, and that was exactly the condition tending to push a lower plate out rather than keep it in.

Mr. Brunton said there was one point he had been expecting to hear mentioned which no doubt many of the members had noticed ; that was not only the slipping forward of a lower denture, but, where springs were worn, also the twisting round. The upper denture would twist in one direction and the lower denture in the opposite direction. He had seen such cases. He himself very seldom used spiral springs, but he had seen such cases occur, though happily not in any dentures that he had himself constructed. It occurred to him that the reason of this twisting round was that the two spiral springs were both coiled in the same direction. Possibly if spiral springs were made, one coiled in the one direction and the other in the opposite, they would not get that twisting. He had never himself tried the experiment of making right and left coiled springs, but he had mentioned it to some of those who supplied springs, and he asked whether some such plan could not be adopted.

The President said he had himself seen cases similar to those alluded to by Mr. Brunton. They were cases which had been worn for a great many years and the cause of the twisting appeared to be that the absorption of the alveolus at the sides left the plate impinging on the palate in the middle. He had never seen twisting occur in freshly made plates, but only where they had been worn for a very long time.

Mr. Vice said he had a case only last week similar to that referred to by Mr. Brunton. The case had been worn for a long time ; the lower arch had very much bulged until the lower piece would not fit at all. The lady dated the movement round to the left side only from her having a

new spring on the right side, and she probably was correct in ascribing it to a new spring on the right side, the old weaker spring being retained on the left. There certainly was some difference in the strength of the springs, and there might have been a tendency to twisting, and the new spring had accentuated it. That might be the reason more than the fact of the spirals being in the same direction.

Mr. S. J. Hutchinson, referring to the loose membrane which was sometimes rather troublesome in fixing a lower plate, mentioned that in one or two cases of that kind which bothered him for a long time, he took a pair of scissors and snipped off the loose mucous membrane from the surface of the lower jaw, allowed the wound to cicatrize, and in that way got over the difficulty most completely.

Mr. Baldwin said he once met with a case in his practice which presented several interesting features. It was a case of an edentulous mouth to which artificial teeth had been fitted. The lower piece always hurt very much, not because it slipped forward, but because it would move about so much. There were absolutely no alveolar ridges left. The alveolar process had been absolutely removed by absorption, or if not absolutely, all that was left was that part to which the muscles, the mylo-hyoid and the genio-hyoglossus had formed an attachment. Those muscles seemed to have acquired an attachment to the lower portion of the alveolar process because the bone at those situations stood up from the general level of the lower jaw. The mylo-hyoid ridge stood up vertically on the inside of each side of the mandible as a very sharp thin ridge of bone, and the genio-hyoid tubercle stood up as a pinnacle in the centre of the back portion of the mandible. The movement of the plate was so great that it was almost impossible to prevent it striking against these prominent portions of bone. It was an interesting point that these muscular attachments were so preserved when there was the greatest possible removal of the rest of the alveolar process. The case presented itself in a vigorous man of not more than 60. The upper jaw was equally flat and

destitute of alveolar process. He had been wearing artificial teeth for a great number of years, and the giving of the alveolar processes work by this means had not conduced to their preservation. The muscular attachments, however, had been absolutely preserved. Another interesting point was that velum rubber was tried as a lining for the plate, and although the velum rubber hurt the prominences less than the hard rubber, the patient eventually had to give up the velum rubber because he was so much annoyed by the constant tendency he found to champ his jaws together and compress the velum rubber. This so annoyed him that he had to ask for the velum rubber to be taken away. A third interesting point was that after almost everything had been tried to make the patient more comfortable, a much larger measure of success was obtained by setting up the artificial teeth very carefully on a Bonwill articulator, paying particular attention to some of the practical points on which Mr. Bonwill laid stress ; that was to say, taking care to have the line of articulation of the two rows of back teeth bending decidedly upwards, and again to set up all the teeth on the movable articulator in such a way that in almost all possible movements of the jaw the lower denture would strike the upper one at three points at once. It required a good deal of care to put up and set the artificial teeth in the articulator so as to fulfil that requirement, but it could be done. If a set were carelessly articulated it would be found on moving the lower jaw about the artificial teeth constantly would strike on only two points at once, and so the lower plate got considerably dislocated out of its normal position. It was possible by paying attention to the practical points on which Mr. Bonwill insisted, to put them up so that in all possible movements the lower teeth should strike the upper teeth always at three points at once.

Mr. W. A. Maggs said reference had been made to one of the diagrams, and he wished to point out that in the diagram of the mandible at birth the mental foramen was represented to be very much higher up than it should be. At this period of life the lower jaw consists practically of

the alveoli of the teeth, the basilar portion being developed later. He thought, perhaps, Mr. Hepburn was inclined to lay a little too much stress upon the mandible itself. It always occurred to him (Mr. Maggs) that the articulation of the jaw was responsible for the forward movement in edentulous persons; and the fact that the *eminentia articularis* in aged skulls was said to be much diminished would tend, of course, to the free movement of the mandible. No doubt the articulation in edentulous jaws becomes very lax; the ligaments give way considerably owing to the tendency of the lower jaw to meet the upper in mastication; and if a sufficient number of aged skulls could be examined a considerable difference might also be found in the neck of the condyle, and probably in the condyle itself. He thought continuous pressure was a good deal responsible for the great absorption of the mandible frequently seen, and in the case referred to by Mr. Baldwin, the wasting of the jaw might have been aggravated by the continuous wearing of the denture. They all knew that continuous pressure produced absorption, and he believed that if dentures were not constantly worn the tendency to wasting in the jaw would certainly be diminished.

Mr. Badcock recommended the adoption of plaster for taking models in such cases as had been referred to. He said that models taken in the ordinary way with composition would show a ridge all round. The muscles were depressed at their attachment to the bone and the model showed a ridge. If, however, a model of the same jaw were taken in plaster of Paris they would not find the ridge. Where an impression was taken in gutta-percha or composition and the case was made, sore places were apt to arise both on the inside and outside of the jaw. This was entirely overcome by taking the model in plaster. It was, no doubt, extremely difficult very often to get a plaster model in the case of an old person, but it was well worth the trouble. With regard to the use of the hot iron on velum rubber, the whole secret was to have the iron hot enough. If it was red-hot it gave the polish described, and a red-hot poker would be found an excellent substitute when nothing else was handy.

Mr. R. H. Woodhouse said he did not think the discussion ought to pass without some allusion being made to the extreme importance of preserving the natural teeth. The sorrows and difficulties described had arisen very often from the reckless destruction of natural teeth. They knew that the alveolus was so subservient to the presence of the natural teeth that the retention of even one tooth, if prolonged, might save all the trouble that had been described that evening. They should, therefore, take every possible means to persuade their patients to bear a little with some of their natural organs. Patients might say, "Oh, the tooth is troublesome—out with it" little knowing the trouble that would arise in the future. They frequently found comparatively young patients who had trouble with their natural teeth and wished to have them out, to be replaced by artificial ones, not realising what an immense amount of trouble and sorrow they would get for themselves in the future. He therefore often pleaded for the teeth of his patients, begging them to undergo the suffering necessary for their preservation. He remembered a case in which an old lady had been wearing an artificial denture for 20 years with springs. She had reached her 86th year. He took an impression of the mouth and started her without springs, and the extreme pleasure the old lady derived was ample compensation for the difficulty experienced at the beginning.

Mr. Hern, with reference to the muscular attachment referred to at the mylo-hyoid ridge, pointed out that if the tray had a deep rim on the inner side it would tend to drive the muscle down, and they got an incorrect impression. If the denture were so low that the movement of the muscles on the floor of the mouth raised the denture, they would be perfectly certain to have an unstable case; and the same remark applied to a certain extent also to the soft tissues on the outer side of the ridge. With regard to the point brought forward by Mr. Brunton when he referred to having dentures turning one in one direction and the other in the other when springs were used, he had met with one or two cases, but they were those in which he thought the

thrust of the swivels was wrong. As long as the denture fitted well the plates were correct, and retained their adaptation, but when the mouth began to change, and the fitting was not quite so correct, then the dentures, the upper or lower, turned round, as a consequence of the thrust of the swivel being inaccurate. It seemed to him that the excellent device brought forward by Mr. Coxon would correct this.

Mr. Coxon said he had omitted to mention that supposing they got a slight soreness in the mouth, by shifting one of those bolts a little bit it could often be relieved without having to cut away, and not only that, but the patients had an opportunity of trying whether they could do without springs. He had often put springs in in that way, and after a time the patient had taken them out and been able to get on very well.

Mr. Betts mentioned the advantage of using a shallow tray, and while taking the model, of asking the patient to protrude the tongue. This effectively modified the impression as to its depth, and the resulting denture was more comfortable.

Mr. Storer Bennett said after the exceedingly able way in which Mr. Hepburn had introduced the debate he had only to draw attention to one anatomical point to which Mr. Hepburn had alluded in regard to the specimens on the table. In going through the museum they saw certain variations in the height to which the *eminentia articularis* was raised. Mr. Hepburn considered that a good deal of the forward movement of the lower jaw in old people was due to the fact that the *eminentia articularis* became very much lower than in adult life. Before it went forth on the authority of the Society that such was admitted as an established fact, a certain reservation should be made. He did not think that in reality the variation in the *eminentia* was by any means sufficient to account for the variation in these movements of the jaw. They must remember the articulation of the lower jaw with the skull was by no means that of the two bones coming together, but of the lower jaw articulating into the inter-articular-fibro cartilage.

Looking at some very old skulls in the museum, in some instances it would be seen that there was a certain shallowness of the *eminentia ;* in others it was quite as high as usual ; and in one specimen of a woman said to be 93 when she died, the *eminentia* was as high as in any adult skull. Therefore, although there might be some slight flattening of the bone, they ought not to allow the statement to pass unchallenged that that had any large share in the protrusion of the lower jaw. The protrusion was probably due more to the fact of the ligaments yielding and the joint itself becoming exceedingly lax in old age. The relaxing of the ligaments had—in his opinion—very much more to do with it than any absorption and flattening of the bone itself.

On motion from the Chair the thanks of the Society were accorded to those gentlemen who had brought forward casual communications, and to Mr. Hepburn for introducing the discussion.

H. P. Robinson & Son, Photo. *Woodburytype.*

HENRY SEWILL, M.R.C.S., Eng., L.D.S., Eng.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

June 4, 1894.

MR. FREDERICK CANTON, M.R.C.S., L.R.C.P., L.S.A., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the preceding meeting were read and confirmed.

The LIBRARIAN reported that Dr. Ottolengui's book, "Methods of Filling Teeth," had been added to the library. Also that he had received in exchange *The Transactions of the Royal Medical and Chirurgical Society.*

The following gentlemen were balloted for and elected as members:—HENRY BARBERY KOWE, L.D.S.Eng., 7, Cavendish Square, W.; S. RALPH APTHORPE, L.D.S.Eng., 1, Tweedy Buildings, Widmore Road, Bromley, Kent; GERALD BERTRAM WEBB, L.D.S.Eng., Guy's Hospital, London, S.E.; JOHN DENCER WHITTLES, L.D.S.Eng., 17, Sumner Row, Birmingham.

The following sent obligation forms duly signed:—LESLIE G. AUSTEN, L.D.S.Eng., Cambridge House, Portsmouth; AUBREY H. B. FAREBROTHER, L.D.S.Eng., 3, New Street, Salisbury.

The following gentlemen were proposed to the Society :— Ashley Bloomfield Densham, L.R.C.P., M.R.C.S., L.D.S.Eng., 18, Stratford Place, W. ; Louis Jeffrey, L.D.S.Eng., 1, Newton Villas, Finsbury Park, N.; George Thompson, L.D.S.Eng., 4, Park Place, Torquay.

The Curator said some specimens of teeth had been sent to the Museum by a non-member, showing rather marked cases of exostosis.

Casual Communications.

Mr. Routledge, in describing a low voltage motor for attaching to any ordinary dental engine without the necessity for structural alterations to the latter, said :—

This low voltage motor is one specially designed to work efficiently with an electric current at low pressure. The reason for designing such a motor is perhaps not at first apparent, but I will explain. Where the only source of current is a battery of cells, it requires a *number* of these to obtain a high voltage. The voltage depends upon the number of the cells, not upon the size of them. Hitherto the great objection to motors has been the large initial outlay requisite for cells ; now whereas other well known motors require from four to six accumulator cells to drive them efficiently, this one will do the same work and only require two. This advantage is a real one—the cells take up less space, require less attention, and best of all, the first cost is reduced to less than half. Again, apart from electrical considerations, take the motor as a purely mechanical device; regarded thus it has one strikingly good feature, one which makes it unique, in fact it is this that affords it its title, viz., a motor for attaching to any ordinary dental engine without the necessity for structural alteration to the latter. This again is a material advantage. Should the cells suddenly run out, or any little temporary derangement occur to the electrical fittings, the dental engine can be made available for pedal power again in a few moments. Again, the question of first cost tells immensely in its favour, a new stand, flexible arm, handpiece,

&c., is not requisite as with other motors; the ordinary dental engine is available without any alteration except an extra pulley band.

As to the advantage possessed by this method of driving over the old foot power, too much cannot be said; the operator is relieved of the necessity for standing in that constrained position rendered necessary by having to drive the engine with the foot while operating with the hands, and the consequent oscillation of the body which more or less occurs.

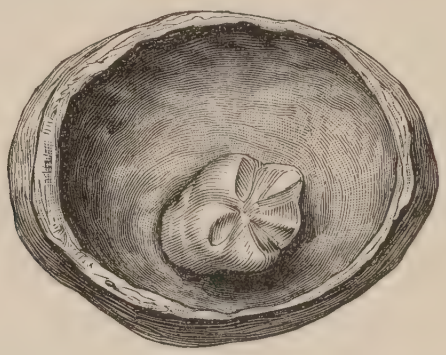
At other meetings where this motor has been exhibited I have been asked the following question: Is the motor available for the direct or alternating current? The answer is that this one was constructed to run from accumulator cells, but it can easily be adapted to either the direct or the alternating supply.

Mr. Northcroft exhibited three pairs of pliers which he had found very useful in his own practice. The first pair was for bending up pianoforte wire for regulation plates. By its use the turns in the wire were made very quickly, and at the same time very evenly. It was also useful for forming up the "w" spring. The second plier or punch was formed so as to make caps out of soft white metal for use in cases of exposed pulp. By using these caps the pain to the patient was reduced to a minimum, and, combined with the use of fibre, he had had no difficulty in any case tried for many months. The pliers were made with three sizes of holes, so that three different sized caps could be made with the same punch. They were inexpensive, and would well repay the initial outlay. The third pair he used to hold teeth in crown and pivot work where it was wished to file the edges of the backing. It was a great saving to the finger nails, and kept one from marring the hands when doing this form of mechanical work.

Mr. Bland Sutton exhibited a follicular odontome removed from the left half of the mandible of the lad presented to the Society at its last meeting by Mr. J. F. Colyer. The tumour was removed in the following manner. The mucous membrane was reflected from the

expansion of the tumour which projected towards the cheek; the bony wall was then divided with cutting forceps and the tumour shelled out by means of a raspatory.

The odontome had a firm thick fibrous wall, and the crown of a molar, with five well-developed cusps, projected into its cavity. The two roots of the tooth, though somewhat irregular, were complete—an unusual circumstance.



A follicular odontome; tooth has five cusps (natural size).

It was thought the tumour might be an epithelial odontome but it turned out to be a follicular odontome (dentigerous cyst). He was right as to genus, but wrong as to species.

To sum up the circumstances of the case briefly, it might be said that diagnosis was good, but not perfect; the operation, simple; recovery, very good; deformity, none; the specimen interesting and useful for teaching.

On the Comparative Effects of Gas, Gas and Oxygen, and Gas and Air, in the same Patients.

By George Rowell, F.R.C.S.

Mr. President and Gentlemen,—The cases which are recorded on the charts before you are, I think, of some interest as showing the relative results of nitrous oxide gas, gas and oxygen, and gas and air in the same patients. Different patients vary so much under anæsthetics that in order to institute a true comparison between various anæsthetic agents it is very desirable to use the same subject. These cases form part of a series of observations which I began in the Dental Hospital of London, with this object in view, but which, unfortunately, I have not had the time to carry on to such numbers as would give the totals a statistical value. But because these cases are fairly typical, so far as my experience goes, of the different behaviour of most types of patients under these three anæsthetics, I have ventured to submit them to this Society.

In the gas administrations the apparatus was provided with an inspiratory valve; special care was taken to exclude all air, and the inhalation

was continued to a point somewhat more advanced than usual, in order to obtain the fullest effects of the gas consistent with safety and the convenience of the operator. This was done for purposes of comparison. The gas and oxygen was given by Dr. Hewitt's method, with the apparatus which he described before this Society in June, 1892.

The method of giving the gas and air was that which I described at the Manchester meeting of the British Dental Association in 1892. Briefly it is as follows. Taking every precaution to eliminate all air from the gas and from the apparatus, pure gas is administered with any apparatus possessing an inspiratory valve, for from 10 to 18 breaths, until the stage in which excitement is producible has passed, or almost passed. Then a single inspiration of air is given. This is followed by 5, 6, or 7 breaths of pure gas, when another breath of air is given, also followed by 5 or 6 breaths of gas. One sometimes proceeds in this manner until either the commencement of what is known as "nitrous oxide stertor," or of slight twitchings, or—and this more frequently—until the breathing begins to become irregular, without either stertor or jactitation. But, on the other hand, it is often found that after some 80 or 90 seconds none of these symptoms have made their appearance, and the face-

piece is removed, as one knows that after so long an administration a good anæsthesia will result. The number of breaths of air to give, and the periods at which to administer them, depend upon experience, and the state of the patient. With noise, movement, active conjunctival reflex, and evidence of only a light degree of anæsthesia, air is withheld; and, similarly, with commencing cyanosis, absent conjunctival reflex, and snoring, air may be given with a freedom which is surprising to those who have looked upon absence of all air as a first essential to successful gas administrations. This method is the one I believe to be the best for giving gas and air. In point of fact it seems not so much to be a matter of consequence how and when the air is administered; to have the gas free from air at first, and not to administer the first breath of air too soon, are the all-important necessities.

In taking these cases I adopted the method practised by Dr. Hewitt, which the Society will remember.

The three patients whose cases are here given had very bad teeth. Beyond this, Case I. was in fair health. She took gas and air first. The air was given rather earlier than usual because her breathing was deep, and twice it was followed by slight phonation. This being so, she was allowed more gas than usual, until slight stertor began,

which was controlled by another breath of air. She had only slight signs of deprivation of oxygen at the end of 85″, and had a good anæsthesia of 42″ after the removal of the facepiece. With pure gas, phonation occurred at 30″, otherwise the administration was typical, but she only had 22″ anæsthesia. With gas and oxygen the phonation still occurred, but soon ceased, and a typical anæsthesia resulted of about 37″.

There was only 24 hours' interval between the administrations, which might tend to render the two last less satisfactory than the first.

Case II. was in a very bad condition. She was extremely anæmic, and was suffering from headache, neuralgia, dyspepsia, and breathlessness. The gas administration was the first, and it was pushed as far as one felt able to push it. The operator was just about to begin the second tooth when she was able to open her eyes—28″ anæsthesia. After a fortnight she took gas and oxygen and 35″ anæsthesia was obtained, of the usual satisfactory character, strongly contrasting, in such a patient, with that obtained from pure gas. The gas and air administration, a week later, resulted in less asphyxial phenomena than with gas alone, and the anæsthesia was 35″ although "slight phonation" is noted at 30″. With regard to after effects, it is worthy of note that the headache was distinctly said to be less after the gas and oxygen.

Case III. was a strong type of girl, who showed great signs of nervousness on each occasion, which, however, gave no trouble after the administration had once commenced. She had a typical gas administration except that snoring developed early, and 38″ anæsthesia followed as against 53″ with gas and air and 50″ with gas and oxygen.

The exhilaration after gas contrasts with the dazed condition after gas and air. The gas and air administration was this time shorter than the gas and oxygen, and the snoring was later in appearing than with gas alone.

With gas and oxygen the snoring did not appear at all, but at 55″ the "distant stertor" described by Dr. Hewitt occurred, and no doubt lasted till the end of the administration, although there is no note of this. I think there was certainly 50″ anæsthesia; it was quite a second after "50" was called by the timekeeper that the cry occurred, and then very little pain was felt.

Let me beg to call your attention to the symptoms at the height of anæsthesia from each of these anæsthetics. With pure gas there are the usual asphyxial symptoms—undistinguishable, Dr. Hewitt tells us, from the symptoms produced by the inhalation of nitrogen. With gas and oxygen the symptoms that Dr. Hewitt has described to the Society were seen. The condition is best

described as "sleeplike." Gas and air holds an intermediary position. The asphyxial phenomena are only slightly developed, and, indeed, a slight degree of cyanosis is often all. The relative merits of gas and gas and oxygen are well known to you. For gas and air I would venture to claim the great advantage of a long anæsthesia. I believe, after trying the method some 2000 times, that on the whole the anæsthesia is longer even than that obtainable with gas and oxygen. It requires no special apparatus, and what may be considered the typical state (very slight asphyxial manifestations, and a long and quiet anæsthesia) is not difficult of attainment.

The disadvantages of gas and air are that noise and movement are perhaps more likely to occur than with gas alone.

If, however, the gas has been given pure for the first part of the inhalation this disadvantage scarcely exists.

I cannot attempt to place details of comparison between these three methods before the Society without more statistics than I have at my disposal. But perhaps I may be allowed to indicate broadly the differences that I feel sure anyone who has tried the three methods will have observed.

	Gas.	Gas and Air.	Gas and Oxygen.
Stertor & jactitation	Necessary.	Not necessary for success.	Absent.
Cyanosis	Marked.	Much less.	Absent.
Pupils	Largest.	Intermediary.	Smallest.
Average anæsthesia	Say 30″.	Longest.	44″ (Hewitt.)

It would seem, then, that air given with gas, by prolonging the inhalation, enables more gas to be absorbed, and the blood to become more uniformly charged with nitrous oxide, and hence is the explanation of the longer period of anæsthesia which results.

Oxygen given with gas does this also, and in a better way, practically abolishing all asphyxial symptoms.

Perhaps I may venture to say that, personally, I use gas and oxygen in preference to either gas and air or gas alone.

But where gas and oxygen is not to hand, I am convinced that a little air, towards the close of the administration, will be found, in nearly all cases, to give more satisfactory results than can be obtained by using pure nitrous oxide.

Case I.—A. E., age 29, servant, fair health, high colour.

Secs.	February 20, 1893. (1) Gas and Air.	Secs.	February 21, 1893. (2) Gas.	Secs.	February 22, 1893. (3) Gas and Oxygen.
	Deep breathing.	10	5 regular breaths.		Oxygen, 3 holes.
30	12 breaths N_2O. 1 Inspiration Air.	20	10 ,, ,,	10	4 breaths, 4 ,,
35	Slight phonation.	30	Slight phonation.	15	3 ,, 5 ,,
40	Breath held for 3″ or 4″, then R. regular.	35	Noise ceased.		2 ,, 6 ,,
50	5 breaths N_2O. 1 Inspiration Air. Slight noise, then quiet.	40	No lid reflex.	26	2 ,, 7 ,,
70	11 breaths N_2O. Slight stertor. 1 Inspiration Air.	45	Stertor, irregular breathing, jactitation	30	2 ,, 8 ,, (slight phonation).
75	Stertor ceased.	50	Face-piece removed.	40	9 holes (quiet breathing).
85	5 quiet breaths N_2O. R. becoming irregular, face-piece removed.			60	10 holes.
				85	No lid reflex, tranquil R.
				90	Face-piece removed.
	Quite quiet, slightly blue. Pupils 4 mm.		Clonus. Deep cyanosis, irregular stertor.		Sleeplike. Good colour, quiet breathing.

Periods of Anæsthesia.

5	3 deep breaths.	8	Regular breathing.	20	Continues quiet.
20	No R. for last 8″ or 10″.	10	No lid reflex.	30	Legs moved a little.
22	5 hurried R.'s, then R. regular to end.	15	No movement, but slight phonation to end.	35	Operation over (4 stumps), conscious about 37″.
35	Slight phonation.				
42	Operation over. Still unconscious	22	Operation stopped (3 stumps), conscious at once.		

No pain or dream with either.

CASE II.—M. T., servant, 20, bad health, much anæmia, neuralgia.

Secs.	February 1, 1893. (1) Gas.	Secs.	February 15, 1893. (2) Gas and Oxygen.	Secs.	February 22, 1893. (3) Gas and Air.
	R. quick, regular.		Oxygen, 3 holes.	10	6 breaths N_2O.
		5	3 breaths, 5 ,,	25	13 ,, ,, 1 BREATH AIR.
20	12 breaths.	10	3 ,, 6 ,,		
35	20 ,,	20	7 ,,	35	6 ,, ,, 1 BREATH AIR.
40	Lid reflex present. Stertor and irregular breathing, 2 more breaths, clonus.	25	7 ,, 9 ,,	40	R. regular, getting longer.
		35	R. quiet. 10 ,,	50	5 breaths N_2O. 1 BREATH AIR. R. quicker.
		45	11 ,,		
		50	R. stopped for few seconds.	60	8 breaths N_2O. 1 BREATH AIR.
		55	Very quiet breathing.	70	R. a little irregular.
45	Inhalation ceased.	65	Face-piece removed.	75	Slight twitchings. Inhalations ceased.
	Deep cyanosis and clonus. Pupils widely dilated.		Good colour. Pupils $4\frac{1}{2}$ mm., no lid reflex. Quiet.		No stertor. Pupils 5 mm., rather cyanosed.

PERIODS OF ANÆSTHESIA.

	Slipped down a little in chair.	20	Lid reflex present. Pupils $5\frac{1}{2}$ mm.	15	Quite quiet.
5	Jactitation ceased.	30	Perfectly quiet.	30	Slight phonation.
15	Quiet.	35	Operation over (3 stumps). A few seconds after gave a sudden cry and became conscious; cried afterwards.	35	Operation over, cried afterwards.
28	Tooth out. Could open eyes when requested. Slight moaning for a few seconds after.				

No pain with either. Headache after each administration, not so bad after (2).

Case III.—E. F. H., nursemaid, 21, plump and strong, very nervous.

Secs.	February 2, 1893. (1) Gas.	Secs.	February 9, 1893. (2) Gas and Air.	Secs.	February 15, 1893. (3) Gas and Oxygen.
10	R. quiet.	10	Moaning.		Oxygen, 3 holes.
20	8 breaths, slight phonation.	24	11 breaths N_2O, quiet. 1 Breath Air.	15	7 breaths, 5 ,,
32	15 breaths, slight stertor to end.	35	6 breaths N_2O. 1 Breath Air.	20	4 ,, 6 ,,
45	No lid reflex. Slight clonus of arms.	40	Slight stertor to end.	25	2 ,, 7 ,,
50	Jerky stertor. Pupils wide.	45	5 breaths N_2O. 1 Breath Air.	30	2 ,, 8 ,,
55	Face-piece removed.	55	5 ,, ,, 1 Breath Air.	35	3 ,, 9 ,,
		82	12 breaths N_2O. Slight lateral rigidity of neck. R. becoming irregular, facepiece removed.	45	4 ,, 10 ,,
				52	3 ,, 12 ,,
				55	Slight "distant stertor."
				60	No lid reflex. Pupils 1½ mm.
				70	Still very slight stertor. R. regular, shallow.
				85	Inhalation ceased.
Deeply cyanosed. Clonus.		Rather blue, no clonus.		Good colour. Quiet. Pupils 1½ mm.	

Periods of Anæsthesia.

	Jactitation rapidly disappeared. After 2 breaths R. quiet.	5	Slight movement of arms, which ceased.	25	Very quiet; pupils still 1½ mm. Slight lid reflex.
25	No movement.	10	R. very quiet.	51	Sudden slight cry, operation stopped (2 teeth). Says she "thinks she felt it."
30	Slight inspiratory noise.	30	Slight phonation, no lid reflex.		
38	End of anæsthesia (2 molars).	50	Something being done till this point. Quiet. Quite unconscious.		
		53	Can open eyes.		
No pain. Ludicrous dream. Exhilarated afterwards.		No pain—no dream. Dazed afterwards. Headache afterwards.		? pain. Say 50″ anæsthesia. No dream.	

Dr. Hewitt said Mr. Rowell had put the matter so clearly before the Society that little was left to say. His remarks were of very great interest as showing that by prolonging the administration of nitrous oxide they could obtain a longer anæsthesia. He hoped Mr. Rowell would be able to continue his comparisons, for if they could get together 100 or 200 of such cases they would have distinct lines to go upon, but even as the cases stood they showed very clearly the relative advantages of the three methods. With regard to the use of air with nitrous oxide he had had very little experience, because he usually preferred to administer oxygen, but he was quite with Mr. Rowell in believing that the use of air with nitrous oxide was certainly preferable to nitrous oxide alone, and was only inferior to the method in which oxygen was used, because the depth of the anæsthesia could not be so evenly graduated, and they were rather liable to overstep the proper boundary either on the side of giving too little or too much air. There was one slight disadvantage connected with the use of oxygen, and one which he never lost an opportunity of pointing out, viz., that after a prolonged administration, where possibly oxygen was used in considerable proportions, there was a greater tendency to nausea—especially with boys and girls—than when nitrous oxide was used alone. He should like to know whether the prolonged administration of nitrous oxide when air was added to it was also likely to lead to this after effect. To himself it was the greatest possible puzzle, and he hoped one day to be able to understand how it was that in boys 12 to 14 years of age when nitrous oxide and oxygen were given together for a considerable time, something like a minute and a half, there was a tendency to sickness afterwards. He had completely given up the use of nitrous oxide for patients of this class, and in fact for most patients, so that he was not really in a position to state whether it was so with ordinary nitrous oxide. It certainly was so with nitrous oxide and oxygen, and he would like to know whether it was so with nitrous oxide and air, because the avoidance of after effects was a matter of considerable

importance in discussing the merits of any system of producing anæsthesia. The use of air with nitrous oxide no doubt lessened the tendency to stertor and jactitation, but in dealing with little children the use of oxygen was far preferable because in these subjects they could not graduate the admission of air with anything like the delicacy that they could admit oxygen. Therefore for very young children the use of air with nitrous oxide was certainly very considerably inferior to the use of oxygen.

On the Treatment of Carious Milk Teeth.

By Edmund Owen, F.R.C.S.,

Senior Surgeon to the Hospital for Sick Children, Great Ormond Street.

Mr. President and Gentlemen,—A professor of astronomy once remarked to a fellow worker that he was going to set out upon the preparation of an essay on the cultivation of cray-fish! "But," said his friend, "you know nothing about cray-fish!" "True," replied the astronomer, "and it is because I know nothing of the subject, and am anxious to learn, that I have chosen it as my theme."

Now, my practical acquaintance with the subject of the proper treatment of carious milk teeth may be likened to that of the astronomer's knowledge of the cultivation of cray-fish, and my reason for inflicting myself upon you this evening may, like his, be considered rash rather than reasonable, personal rather than praiseworthy; but I wish to be informed. Having thus confessed the weakness of my position I will throw myself upon the mercy of the Court, and beg you to deal leniently with me.

Let me say again that I am not here as a teacher but as a learner. I claim that the spirit

of the advice which Bottom gave to a fellow player may be applied to me: "*If you think I come hither as a lion, it were pity of my life; no, I am no such thing.* And there, indeed, let him name his name; and tell them plainly he is Snug the joiner."

But though I consider myself incompetent to say exactly what ought to be done with carious teeth in childhood, may I venture to place before you certain thoughts which have occurred to me, a general surgeon, in connection with this interesting and important subject? I do not expect that you will accept my views as altogether right, but, on the other hand, I am convinced that they are not altogether wrong. Still even if we agree to differ, I am sure that the time spent over the consideration of the subject will not be wasted. Whilst, if you will be good enough to admit that, after all, there may be some justification for my remarks, and give practical consideration to them, I shall be more than content.

The first question that I am going to submit is this: Are you satisfied, are you quite sure that your treatment of carious molars in children is sound and right? By this I mean, are you convinced that the insertion of a filling is the best treatment for the average carious molar of the average child? There is one answer which must not be given. It would be begging the question

to say that treatment by filling the child's carious tooth is the result of evolving science, and, therefore, a distinct advance on the old measure of extraction. The adoption of novel and apparently scientific methods of treatment does not necessarily imply advance.

When a down-train and an up-train are side by side in a bustling railway station, the movement of the up-train makes the down passenger think that he is progressing when, as a matter of fact, he is standing still, or actually undergoing a little backward movement. He *thought* that he was advancing. Possibly you may be under the impression that dental surgery is constantly advancing in all its branches. If so, then, it is very different from general surgery. The evolution of "Science"—falsely so called—has recently, in at least two conspicuous instances, put back the hands of the dial of general surgery, so that at the present day the boy with a vesical calculus, and the man with a popliteal aneurysm do not stand nearly such a good chance of recovery as they would have done twenty years ago. No, advanced treatment is not always surgical progress. Can you show that the comparatively modern treatment of carious milk teeth is unmistakeable progress?

Some of you may have heard tell of a landed proprietor who, many years ago, had a tree on

his estate which was doing harm rather than good. He told his gardener to remove it, but the gardener persuaded him to let it remain for another year so that he might "dig about it, and dung it." I wish that we could have known what was the result of this treatment, but the further clinical history of that tree was not recorded. My own opinion is that the tree did not answer to the means adopted, and that it was at last rooted up. But I do not speak from actual knowledge.

The line which I propose to take this evening in connection with the treatment of carious molars in children is somewhat after that of the landowner in the parable, and I place you in the position of the dresser of the vineyard asking that the teeth may be spared, so that you may dig about them and fill the excavations thus made with stopping. All that I want to imply is that I think that you are carrying this treatment too far. I do not for a moment suggest that you are never to deal conservatively with carious milk teeth, but I wish to urge that many cases would turn out much better without such treatment. From my point of view when it fails the failure is apt to be great and regrettable.

I think that I know why you so often decline or hesitate to extract the offending tooth; is it chiefly on account of the fear which overshadows

you lest its removal should prevent the due development of the maxillary arch? If this surmise of mine be correct, I will ask if in your opinion the developing jaw depends for its perfect evolution upon the presence of carious teeth in its alveolar process rather than upon the dental sacs inclosed within its base. For my own part, I should think it probable that if every one of the temporary teeth were extracted soon after its eruption the basilar process and the jaw would, nevertheless, attain their normal size and shape in due course. But this is only a speculation, and you may possibly be able to show by chapter and verse that it is fallacious.

I suppose that you are also afraid that if the milk molars are removed the bicuspids and the permanent molars may, so to speak, have to scramble for their places with the risk of not finding room. That the first permanent molar—the six year old molar, I think you call it—will especially be impeded in its eruption, and will become awkward and unruly. Well, if the permanent teeth are going to crowd up in such an ill-mannered fashion, just because some carious and harmful milk teeth have been extracted, you can watch and weed them if there be not eventually room for them all. Surely this would not be faulty dental surgery. But, then, you must have prolonged supervision over the child. Of

course the most satisfactory way out of the difficulty would be to make the environment of the child such that the temporary teeth should not become at any time the happy hunting ground of septic micro-organisms, but remain sound and useful tissues until the permanent teeth were ready to take their place. Then all would go happily as wedding bells. But as this cannot be, let me ask you to regard the question for a while from the point of view of the general surgeon, and not to sacrifice the child's health and personal appearance—or risk their sacrifice —in order that the permanent teeth may be enabled to conform to some physiological standard as to size and site. Permit me to say that I believe that you are carrying conservative principles, most admirable in themselves, a little too far. In general surgery we are doing the same thing ourselves every now and then, and especially so, I think, in the case of local tubercular disease. Such errors come from our increasing power and knowledge. We are always anxious to save rather than to sacrifice, and thus the splendid spirit of conservatism is being occasionally discredited.

There is one point in connection with the dental surgery of children which I am sure has not received the attention which it so urgently demands—it is that children's mouths should

undergo regular periodical inspection. With half a glance the dental surgeon sees what is wrong, and with comparatively little difficulty he could then put it right. But too often dental defects and irregularities are allowed to drift on undetected, uncared for, and when at last the dental surgeon is consulted, his opportunity has passed, or his power of doing good work is crippled. Further, I think that it would be a good thing if the Medical Council required that every one entering upon the general practice of our profession should possess at least a rudimentary knowledge of the anatomy, physiology and pathology of the teeth. And in that I have been so bold as to bring a Paper before gentlemen practising dental surgery, will not one of you offer, *en revanche*, to lay your views upon some common subject before one of our general medical societies? Such a paper might insist, amongst other things, upon the desirability of the general surgeon and practitioner possessing a working acquaintance with the number of teeth in the temporary and permanent sets, and of the respective dates at which some of the more notable of them should be expected to make their appearance. But it might, I think—at any rate for the present—omit from consideration the treatment of carious milk molars; we shall have had enough of that to-night.

Let me now suggest a case for your consideration :—Here is a boy five years old with a carious lower molar ; it began to go wrong after a severe attack of measles. He is afraid to eat upon that side, and the tooth looks so unpromising that the dental surgeon, to whom he has at length been brought, is disinclined to place in it even a temporary filling. The boy has had several attacks of toothache, and a lymphatic gland below the angle of the jaw is already enlarged and tender. Why, I ask, does not the dental surgeon promptly extract that tooth? I am sure that he ought to do so, as its removal may prevent the child becoming the subject of cervical abscess, for septic micro-organisms are already finding their way from the pulp-cavity to the associated lymphatic gland. Why does he decline to extract it? He does decline, however, and I think that this is because he foresees some possible contingency in connection with the eruption of the permanent teeth. But, in the meanwhile, can he insure the child against secondary glandular abscess in the neck? No. Therefore, to me, at least, his temporising appears unsurgical and dangerous.

Here is another case, but not so far advanced: It is that of a carious patch in the crown of the second molar of a boy of eight. He has had severe toothache, and a gland is tender below the jaw. The wall of the tooth is healthy looking and

strong. The boy is a little Spartan. What are you going to do for him? You will examine the tooth—the pulp is exposed and exquisitely tender; you will devitalise it; shape the cavity and bring down the soft tissue from the root of the fang by a Donaldson bristle.[1] Am I right? Have you ever had a Donaldson bristle passed up the fang of your own tooth? I have! And you may take it from me without question that no child could stand the ordeal twice; but unfortunately a molar has more than one fang: and unless you have thoroughly cleaned out each fang, filling the cavity is merely rolling a stone over the mouth of a whited sepulchre. In such a case future trouble is almost inevitable. The very germs with which the dental surgeon temporises in the alveolar region will subsequently be encountered by the general surgeon in the submaxillary glandular abscess of this boy. The opinion has been steadily forced upon me that this advanced conservatism in dental surgery must be held responsible for no inconsiderable proportion of the cervical glandular abscesses of children. The dental surgeon *sometimes* permits his views to be limited by too narrow a specialism, refusing to look beyond the limits of his patient's dental

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[1] See "Diseases and Injuries of the Teeth," by Smale and Colyer," Longmans, 1893, page 18.

arch. He should never forget that the germ-laden fangs may do incalculable damage to the glands descending along the side of the neck; but he occasionally seems to cherish them with a regard and confidence which are as much misplaced as is the generosity which a Home Secretary extends to an Anarchist club.

Messrs. Smale and Colyer—to whose excellent book on dental surgery one naturally turns for enlightenment—say (p. 18), "It is also recommended by some, in the place of filling the pulp-cavity, to cap it and perform rhizodontrophy." They have, apparently, nothing to urge either for or against this line of treatment; I much regret that they did not condemn it altogether. What is this but to convert the pulp-cavity into a natural incubator, in the moisture and warmth of which the septic micro-organisms will develop without let or hindrance? Messrs. Smale and Colyer thoroughly realise and duly refer to the great danger of the passage of these germs through the apex of the root; but I venture to think that the precaution which they advise against its occurrence is insufficient. They say that, before stopping the tooth, the canals should be tested to see if they are aseptic, "by passing a small piece of cotton wool on a bristle, and if free from odour when removed the cavity may be filled." I fear that septic organisms might exist

in abundance in the tissues immediately adjacent to the area of excavation, and yet give no evidence whatever of their presence to this test. And even if there had been but a few of them present when the filling was inserted, the effect might have been as disastrous as if there had then been of them a host as countless as the stars of heaven.

Permit me thus to lay before you my conclusions:—Carious milk molars are often a cause of great distress to children, and they are always a dangerous source of septic infection of the cervical lymphatic glands. Unless the carious patch is slight and superficial it cannot be rendered absolutely aseptic, as children cannot tolerate the pain, manipulation and constraint which are needed for that purpose. The development of the jaw depends upon the presence of the dental sacs of the permanent rather than upon that of the milk teeth. To increase the happiness of the children, and to diminish the risk of glandular infection and abscess, the best treatment for the general run of carious milk molars is extraction. When a milk tooth is only moderately involved in caries, filling is of problematical value—the game is rarely worth the candle. Only when the decay is slight and the child tolerant of thorough and efficient handling should cleaning and filling be resorted to.

Discussion.

Mr. F. J. Bennett said he wished to thank Mr. Owen for the valuable hints he had given. One could not be too often reminded of other people's points of view. They were often apt to be too one-sided, but at the same time he ventured to think that their position as dentists had not been materially assailed by the paper. He would first point out that the conclusions to which they would most of them come was that undoubtedly the permanent teeth were materially injured as regards crowding by the premature extraction of temporary teeth, whether carious or not. That was a position which over and over again had been fought out by means of measurements of all descriptions of models by Mr. Tomes, and by others whose names carried great weight. There were also specimens in the Museum which would he thought convince even Mr. Owen that the permanent teeth were actually held back by the crowding of the temporary teeth which remained. If one temporary tooth was taken out say in the bicuspid region, the first molar and the first bicuspid might so come together as to quite prevent the second bicuspid erupting at all. He did not think that any member of that Society, or, indeed any good dentist would be inclined to retain a temporary tooth when the lymphatic glands beneath the jaw had enlarged; therefore that was out of the question. He had brought down a specimen, thinking Mr. Owen might touch upon that subject, which gave an argument both ways. Mr. Owen did not allude to the evil effects of carious temporary teeth when they advanced so far as to produce alveolar abscess and to destroy the developing permanent teeth. The model produced played into his hands, so to speak, at the same time had that tooth been

stopped at an early age they need not have had that result. With regard to exposed and inflamed pulps of children's teeth, the acute pain spoken of in adult teeth was not quite so bad in children; it rapidly ran its course, it was not complicated with pulp stones or calcified masses in the pulp, and therefore the application, either of a minute quantity of arsenical fibre, or even of strong carbolic acid would often stop severe pain without doing very much damage.

Mr. Charters White said one could only speak from one's own experience, but no doubt it was very desirable on the whole that teeth should be retained. One point for which they ought to thank Mr. Owen, was his remark as to the difficulty of getting constant supervision of the teeth of children from the ages of 5 to 8. Parents very seldom brought them until they suffered pain, and then it was too late to do very much. The plan he adopted in practice was to put some strong carbolic acid into the cavity, and then run some very thin oxy-phosphate stopping into it, letting it set, and in that way the tooth was kept for a very long time. He did not believe in putting arsenical paste into the temporary molars of a child, for as they knew the pulp of a temporary tooth was very large, and sometimes a good deal of ulceration was produced. With regard to putting a Donaldson bristle into a child's temporary molar, he did not think it would be at all advisable and would not be practised by any one who had much to do with the temporary teeth of children.

Mr. George Cunningham said an earnest consideration of the paper would prove that it was not only of great value to dentists, but was also of great value to medical men. The point as to the advisability of the Medical Council making it compulsory that every medical man should know something about the anatomy, physiology, and pathology of the teeth was of the greatest importance. Mr. Owen had suggested that it would be well for somebody to go "missioning," as he had himself done that evening, and to read a paper before some of the Medical Societies. One Medical Society had approached a member

of the Odontological Society, with a view of his addressing them on "How best to preserve Teeth." The gentleman so approached suggested that the lecture should be on the "Preservation of the Function of Mastication," something more than the mere preservation of teeth. The Medical Committee found it unprecedented that a gentleman not a member of their Society should address them, and after considerable expense had been incurred the paper was withdrawn at the urgent request of the Medical Society. However, it was perfectly evident so far as the Dental profession was concerned that if rightly approached they were ready to undertake such work when they were sure of getting a reception. With regard to the cases brought before them by Mr. Owen he did not think any one would go in for an elaborate dental treatment of the carious milk molar where it was complicated with swelling of the cervical glands. Mr. Owen had suggested that the dentist's idea in the preservation of the milk teeth was to prevent crowding. No doubt that was a very serious factor, and he did not underrate it for a single moment; but the most important factor of all was this, that the child had got molars, and the molars were intended to be used, and if those carious molars were not treated the child went without performing the natural function of mastication. That was the principal factor. Mr. Owen had told them there ought to be periodical inspection. The trouble was not that the dentists saved too many teeth; in many cases they erred by extracting too many milk teeth, and the common practice of dentists was rather extraction than careful filling. The great point was to encourage the bringing of children earlier to the dentist, and thus avoiding the horrors of the dentist's chair. He appealed to any one present if it was not possible to treat children in such a way as to preserve the functions of the jaws, and at the same time altogether obviate the horror of the dentist's chair. He thought that this could be ensured if the children were brought early when the cavities were in the first state of decay, and did not necessitate a clearance of the pulp cavity or root treatment. With regard to rizodon-

tropy he thought the sooner that operation was wiped out of dental practice the better. They owed the essayist a debt of gratitude for pointing out the subject of testing the aseptic condition of the root canal, for to test it with the olfactory sense was certainly a very unscientific method. With regard to the final conclusion of the essayist, that children would be happier if there were more extractions, he thought it was bad enough in the case of an adult, but it was far worse for a child when its teeth had to be taken out prematurely. With the divergent roots the strain and struggle for the child were often great. That must be avoided as far as possible; at the same time in serious cases with complications of a secondary nature he did not think anyone would hesitate to assume the function even of an executioner. There was one point in the treatment of temporary teeth in the early stage of decay which he thought had not been sufficiently practised. They knew perfectly well that the reason why teeth decayed so much was because of congenital defects in the fissures of the molars. He had found it good practice to fill such teeth even before there was such a cavity as to make it desirable to use the dental engine. When they found deep crevices in the molars wherein food would lodge and decay follow, it was well to fill them as a preventive. Amalgam by itself was not adhesive, but it could be made adhesive by putting a layer of phosphate cement as a lining. It was not antiseptic in its character, but it could be given an antiseptic character by mixing with it a little sulphate of copper. By this means a great number of teeth might be saved, without the child ever knowing anything of the pangs of the drill. They must get rid of the adult's notion of the horror of the dental chair. For the child the dentist's chair should be attractive, but in order to secure this the children should be brought from the first, even from the age of two or three years. He had known cases where children came to look upon a visit to the dentist with pleasure, but that was where it was not necessary to use a Donaldson's bristle or any such complicated arrangement as the dental engine, the use of which was owing in great

measure to the neglect of the parents and the apathy of medical men with regard to early treatment. He urged that the dental surgeon should do his best in order to modify his operations to suit the child, thereby keeping the child from any dread of the dentist.

Mr. Sidney Spokes said he had thought that Mr. Owen in alluding to swollen cervical glands, would have referred to that which was even more serious than the ordinary septic infection, viz., the entry of the bacillus of tubercle into the organism of the child, which might have been adduced as an additional reason why carious molars should not be neglected. He did not suppose that dental practitioners were really open to the charge of neglecting carious molars. The charge brought against them was as to the treatment they should adopt with regard to them. With reference to the premature extraction of temporary milk molars, and to rhizodontrophy he stated that he had records of over a thousand children's mouths, many of which he had seen twice during the year, in most of which he had filled permanent teeth, and in some few temporary teeth. The whole question with regard to the extraction of the temporary molar, and its influence upon the permanent molar, was the period at which the extraction took place. He believed that the subsequent development of the jaw would not be influenced by the extraction of the temporary milk molar. He would be inclined to go further back, and to say that the child inherited a certain development of jaw, and so long as a certain amount of nutrition was kept up in the child it would maintain the development of jaw handed down to it by its ancestors. Whilst he was inclined to go in for symmetrical extraction of permanent teeth he thought the symmetrical extraction of temporary molars should be avoided as far as possible. Supposing in the upper jaw the second temporary molar was perfectly sound, and the lower secondary temporary molar was bad and unhealthy, and it was a question whether they would resort to rhizodontrophy or a Donaldson bristle, he did not think they were doing very much harm in extracting that lower second molar, because he did not believe the first permanent molar

would be able to travel forward. He had distinct notes of such cases in which the second upper temporary molar was perfectly sound and strong, in which the lower temporary molar had been extracted and the first permanent molar had been unable to come forward. It had been a case of interlocking in the articulation. He was not in favour of the use of the word "rhizodontrophy," but preferred to use "rhizodontropy" as a more correct term.

Mr. J. F. Colyer wished to thank Mr. Owen very much for his paper which opened up many points of interest. He was particularly interested in the treatment of children's teeth, but certainly thought Mr. Owen looked at that question from a rather pessimistic point of view. He thought that in cases where they met with children with tuberculous glands, or where the surgeon met with them, it would be much better if the surgeon and the dentist held a consultation upon the point. In many cases where these tuberculous glands were ascribed to certain temporary teeth, when carefully examined to see whether the lymphatics actually drained into the gland, they often found that another source must be sought, and in many cases swollen glands about the neck might very often be attributed to other lesions about the patient. Twice within the last year he had had patients with enlarged lymphatic glands in the cervical region, and had been asked to extract some carious temporary molars; on both occasions he discovered that the trouble was due to other causes. When he met with a case of swollen tuberculous gland in the region of the jaw, and really thought it was due to the carious tooth, he did not hesitate to extract, but because a patient came to him with a dead carious molar he was not necessarily going to extract it; on the other hand, if there was any tendency to glandular enlargement about the neck he should extract it. If he had a child come to him, perfectly healthy, with a dead carious molar, he should certainly endeavour to save it. Then as to the manner of saving these temporary teeth. Mr. Owen referred to a case of a temporary molar with an exposed nerve and a tender gland under the jaw. He (Mr. Colyer) had always understood that there were no

lymphatics in the pulp; how, then, was this exposed pulp causing a diseased gland under the jaw? In the case quoted by Mr. Owen, in which he considered it would be much better to extract the tooth, he (Mr. Colyer) would undoubtedly say that the child should have had the pulp of that tooth killed and treated in the proper way. He wished to defend the use of arsenical paste in temporary teeth. Practitioners constantly said they had never used it, but he failed to see any reason why arsenic should not be put in a temporary tooth. The only thing was not to leave it in too long, but he was quite sure that in the majority of cases arsenic might be put in with safety. Then as to the treatment of a tooth perfectly dead; they were asked how they were going to treat a carious dead temporary molar? He was rather inclined to clear out the pulp canal as thoroughly as possible, using antiseptics, getting it as clean as possible. He should certainly use cotton wool, and if on passing cotton wool down the root canal it was found perfectly free from odour, that was a fair test that the canals were free from septic matter. He would ask what scientific method Mr. Cunningham would use in order to determine whether the root canal was perfectly aseptic? He (Mr. Colyer) knew of none, except the test with cotton wool. There were cases in which they could not get the canal clear, in which rhizodontrophy was perfectly justifiable, and he did not at all mind owning that under such conditions he did perform it. What other treatment he could adopt he did not know. There were cases where they could not fill the pulp chamber, but where, by performing rhizodontrophy, they were enabled to save the temporary molar for two or three years. If the canal was filled with some antiseptic and rhizodontrophy was performed, the child being perfectly strong, there would be no septic infection of the glands. Mr. Cunningham had referred to the early treatment of temporary teeth. Dr. Kirk had recently written in the *Cosmos* that in the case of six-year-old molars, where he had thought the fissures might increase, he had put in a patch of oxyphosphate. That seemed a very reasonable treatment,

and one that might certainly be adopted. When a patient came with a lymphatic gland enlarged and a carious temporary molar, it was well to be quite certain that there was not some other cause for the enlarged gland. There was one point which had not been referred to, but which he considered the principal cause of swollen glands: it was not so much the carious temporary molar, but the six-year-old permanent molar. Summing up their experience with children, he thought they should adopt every available means to save the teeth. If the work were done thoroughly, if the nerve were killed and the pulp canal were in an aseptic condition, they would save the teeth of the children without incurring any further trouble.

Mr. Storer Bennett said they would all agree that Mr. Owen's paper had been at any rate amusing. Mr. Owen came there as a visitor to give his opinions on these matters, but he was quite confident that were Mr. Owen to present himself at any of the examining boards and there produce the opinions he had now given on the physiology, pathology, and surgery of the teeth, he would not find those opinions accepted. There was hardly a statement made by Mr. Owen that evening which was not capable of being challenged, and it would be exceedingly unfortunate to allow such a paper as they had listened to, to pass without challenge. Mr. Owen had stated that one reason why it was objected to take out temporary molars was that it was thought that the jaw would not afterwards develop. That was an opinion long since abandoned by everybody. He stated, secondly, that they were afraid of clearing out the temporary molars because crowding and jamming together of the teeth would subsequently take place. Mr. Owen, of course, had not had the same opportunities of seeing and treating irregularities of permanent teeth as many of them had, but he was quite sure that if he had had such opportunities he would have spoken in a different manner as to the result of clearing out the temporary teeth. He was perfectly certain that Mr. Owen did not appreciate in any degree whatever the risks he was running of materially damaging the whole development of the arch by

the ruthless extraction he advised. As an instance of somewhat curious pathology, Mr. Owen had spoken of the extraction of a tooth with swelling at the roots and tenderness about the gum. The patients he described were certainly not suffering from caries of the molars only, but the chief symptoms were those of periostitis. He spoke as though caries of teeth was the only thing the patient suffered from, which seemed to be perfectly outside the mark. Mr. Owen had thrown an aspersion on the care of the average dentist in saying that swellings took place under the jaw and the dentist did not notice them. The general matter of routine was to put the hand under the jaw to see if there was any tenderness. He was perfectly confident that the average dentist was a far more careful man, and far more experienced in his special work, than Mr. Owen appeared to imagine. With regard to treating the pulp in temporary teeth and the ruthless use of the Donaldson bristle, he could only say if that was the kind of treatment that Mr. Owen had seen, his experience had been somewhat peculiar. It was only just to members of their profession, who were apt to be very unfairly treated by surgeons, to say that he was certain that there was no one dental surgeon who would treat such a case in the manner described. No doubt Mr. Owen, wishing to emphasise the importance of not allowing any source of infection to the cervical glands to exist, appeared to think that as carious molars were capable of being a source of infection they were always the source. He wished fully to agree with what had been pointed out by other speakers as to the importance to young children of a continued inspection of their teeth extending over several years. He thought it was not fair to pass over the paper and the praise that had been given to it without offering these criticisms, although no doubt they were greatly indebted to Mr. Owen for bringing forward the very interesting subject.

Mr. W. B. Paterson said he thought they were getting rather too serious. It appeared to him that Mr. Owen, from what he gathered from the paper generally, advised the extraction of temporary milk molars. Mr.

Owen gave them the key of the situation in his paper, for later on he said that by a proper periodical inspection of the milk teeth the dentists might be able to arrange matters. By a proper periodical inspection they never got cavities going on to exposure of the pulp, they never got abscesses, inflamed glands, and that sort of thing; they treated the small cavities when they appeared, and saved the teeth until the time for their loss arrived. Mr. Owen distinctly raised a good many points that had been met by Mr. Storer Bennett in what he (Mr. Paterson) thought rather a serious manner. It was true enough they believed the early extraction of temporary molars crowded the teeth, leading to trouble afterwards; but they did not believe, as Mr. Storer Bennett had pointed out, that it made any difference in the growth of the jaw. The paper must not be taken too seriously. Mr. Owen had been reading a special book, the book of Smale and Colyer, and perhaps had devoted more attention to the treatment of permanent teeth than to that of temporary teeth. He (Mr. Paterson) could not help thinking from his recollection of the book that there was some qualifying statement with regard to the treatment of temporary teeth which had not been quoted, seeing that the quotations made by Mr. Owen and the remarks made by Mr. Colyer did not exactly tally. His object in rising was to prevent the discussion becoming too antagonistic towards Mr. Owen.

Mr. Bland Sutton said he was simply present because he had heard that his friend Mr. Owen was going to interest the Society in a question of some importance. He could always learn something from discussions as to the treatment of children, and he had done so that evening. He knew very little about milk molars, but he had attended that Society, and when he first became assistant-surgeon to a general hospital he thought he was very clever. He used to take cases in the out-patient department and consult with his dental colleagues as to the advisability of extracting teeth when children had enlarged glands, and they used to tell him it was not the teeth which caused the glands but something else in the mouth. For a time he was rash

enough to take the matter into his own hands and pull out the teeth himself; but when he learnt more discretion he began to feel that his dental colleagues were right, and for this reason, that when the gland had enlarged the mischief was done, and although the tooth was extracted they subsequently had to enucleate the gland under the jaw. That was a point upon which Mr. Owen might enlighten them—as to whether when the glands under the jaw had become enlarged and the milk molars, which he thought the source of trouble, extracted, the swelling of the glands not in all, but in a fair proportion of cases, subsided. His (Mr. Bland Sutton's) experience was, that they did not. Statements had been made about making all general practitioners very wise about the teeth. The general practitioner was already overburdened; he knew the eye, the skin, all kinds of things. He should not be pressed too much about the teeth. Mr. Owen had it in his power to produce a very great alteration in the minds of the present generation of students as to their knowledge of the teeth, as an examiner at the Final Board of the College of Surgeons. Those examiners had a greater power for good than they thought they had, and if at the next examination Mr. Owen would set some such questions as those described on the various troubles in the neck, which might arise from troubles in the teeth, he might not get very good papers at that examination, but that day six months there would be a marked improvement

Mr. Owen, in reply, said he rose with mingled feelings; first of all his feelings were those of gratitude at being let off so easily; secondly, his feelings were those of disappointment, because the discussion had not followed the lines of his paper. One of his questions was, what were they going to do with the tooth with a lymphatic gland beneath it, which was large and tender? That was the point which had induced him to read the paper; but yet it had not been duly discussed. He had a child of his own about five years of age, with a carious lower molar and an enlarged gland. He sent her to a dental friend requesting him to examine it, and if he thought well, to remove the

tooth. He sent back the child, stating that he did not think the case should be so treated. Another excellent dental friend was then consulted, and he also would not take out the carious tooth. These two illustrious dental surgeons did not suggest that the tooth should be filled—it was past that—but they declined to extract it, for fear, it seemed, of offending the unseen permanent teeth. The tooth was, however, eventually extracted, and the lymphatic gland promptly subsided, and he believed if it had not been extracted, the gland would have suppurated. That would answer Mr. Bland Sutton's question as to his experience about the removal of carious teeth when the lymphatic glands were enlarged; it was just a case in point, and they might be sure that he had regarded it with the greatest interest. He would ask if the tooth had been allowed to drift on until it was absolutely rotten, what would have been the good of trying to keep it? It was a constant and tremendous source of infection. It was not correct to say that he advised the ruthless extraction of every carious tooth, and in suggesting it Mr. Storer Bennett put words into his mouth which he really did not use. He did not wish to extract every carious tooth, but he did want to insist that if one had a carious tooth to deal with, and the child was suffering pain, the game was rarely worth the candle to try and stop it, particularly if there was an enlarged gland beneath the angle of the jaw. Although sometimes, as in the case he had mentioned, on the carious tooth being removed the gland would subside, still there were cases in which, although the tooth was extracted, the gland beneath the jaw required to be excised or underwent softening and suppuration. Mr. Owen stated that he agreed with Mr. Bland Sutton that the general practitioner should not be made very wise over the matter of dentistry; indeed, all that he desired was that the general practitioner should know how many teeth there were in the temporary set, how many teeth there were in the permanent set, and something as to the time when they were erupted—that was all. With regard to Mr. Cunningham's remarks as to his "missionary enter-

prise," that gentleman appeared to allude rather bitterly to some Society which had asked some one to read a paper, and then declined to receive it. He was sure that if a qualified dental surgeon asked any Society of medical men to be allowed to read a paper, the Society ought to be duly grateful, but it must not be on such a subject as "mastication;" it must be on some topic which was interesting to the medical members as well as to the dental element which would flock to the Society on that occasion. Mr. Cunningham had read him a little lesson about the physiology of molars. He might not quite know what the exact physiology of the molar might be, but he was sure that if there was a carious molar with an exposed pulp, it was something worse than absurd to expect that the child would use it "physiologically." It would not eat on that tooth, and on examination it would be found that the molars in the neighbourhood were covered with a yellow fungus, showing that that side of the jaw was not used at all. The tooth was no use, and was absolutely harmful. He would not deny that a crowding of the permanent teeth might be produced if some of the temporary teeth were removed, but in such a case a periodical inspection would enable them to keep the teeth right. He had seen what could be done by putting the crowding teeth right, but surely they were not going to leave a carious, gland-infecting tooth in order to prevent a crowding of permanent teeth, which could easily be put right by judicious manipulation. The difficulty of supervision had been alluded to, and no doubt it was very great. He fully approved the idea of getting at the pulp, destroying it with strong carbolic acid, and then putting in some fluid stopping. Strong carbolic acid was an extremely valuable antiseptic, and if every pulp could be thoroughly destroyed he had no objection to the tooth being filled, but it must be thoroughly done. He was afraid that this infection of the gland was tuberculous. First of all, the vitality of the gland was lowered by the irritation of the tooth, and this lowered vitality predisposed the gland for the germs of tuberculosis. He thoroughly agreed with the idea of consultation between the surgeon and the dentist,

it was really most desirable. The dentist did not always look with the eye of the general surgeon below the jaw, and the surgeon was not as conversant with the methods of his dental *confrère* as he should be. He was quite sure that rotten useless teeth ought to be removed, and that it was only a few teeth which would lend themselves to stopping, and should be treated in a conservative manner.

The PRESIDENT moved the thanks of the meeting to Mr. Owen for his paper, and also to those gentlemen who had brought forward Casual Communications.

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